

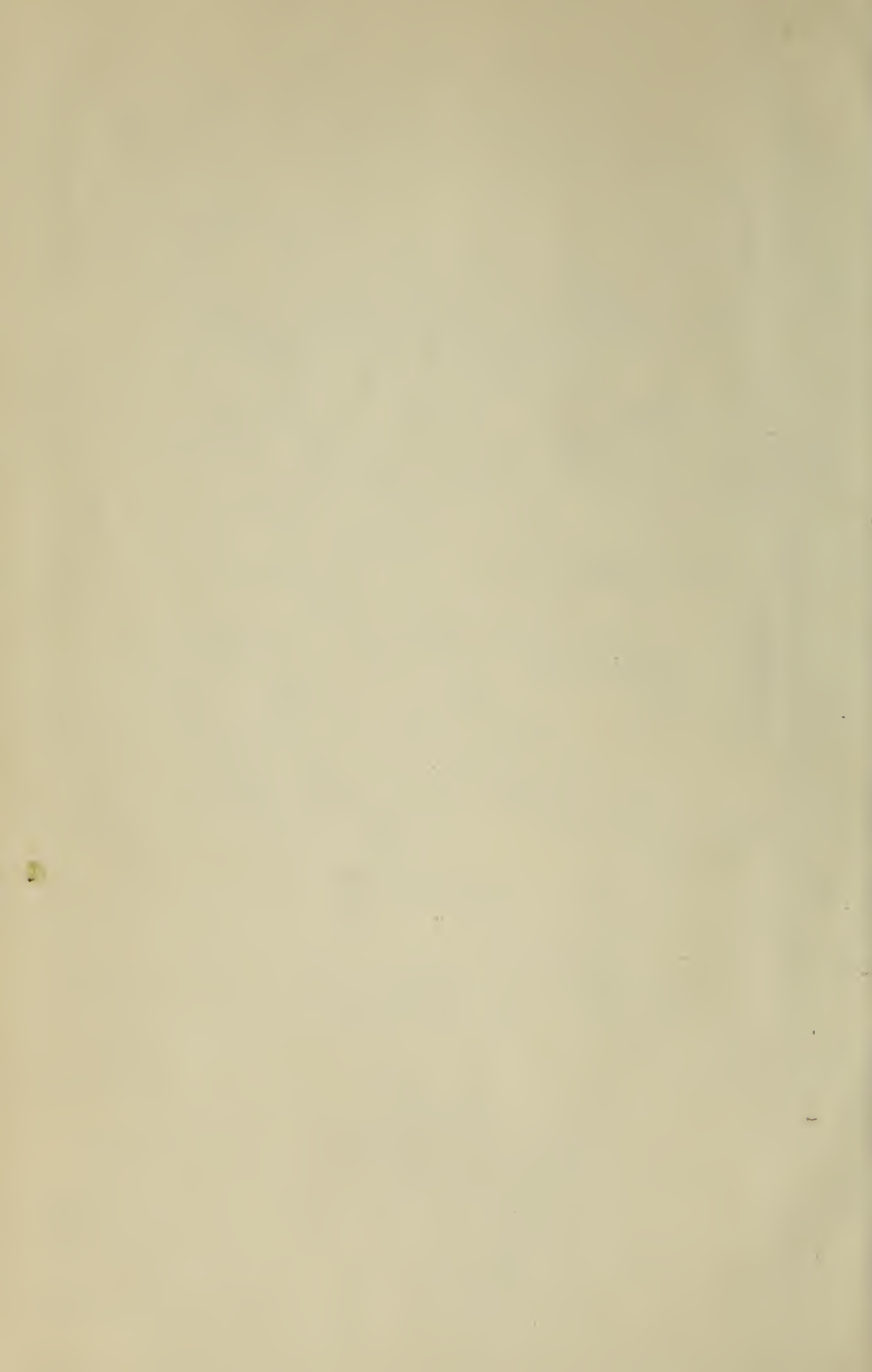


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I N D I A N A C A V E S

and

THEIR FAUNA

by

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Indianapolis, Indiana.

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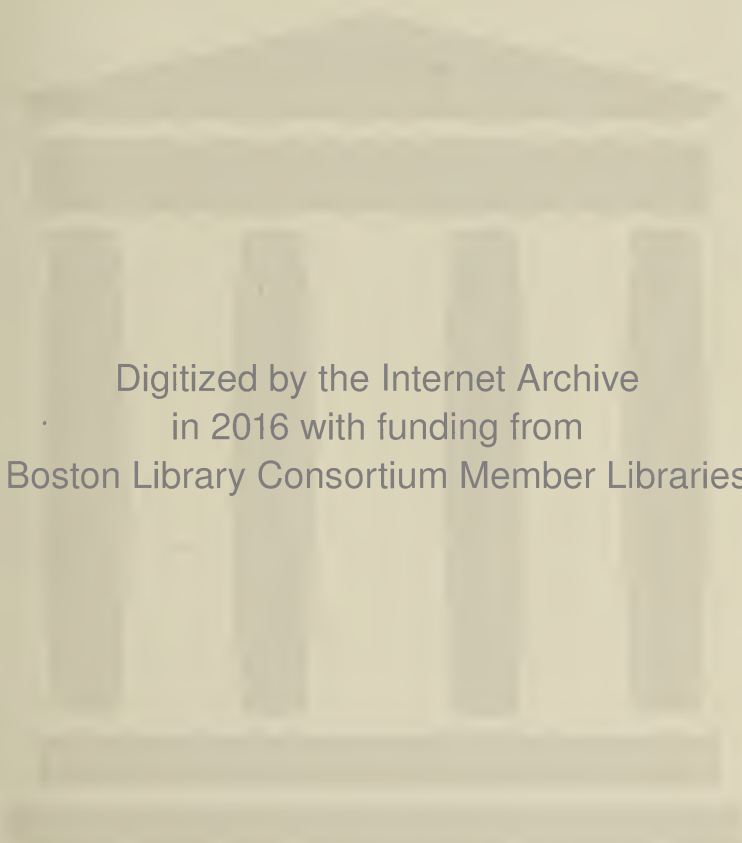
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WA HING ON'S MONUMENT MARENGO CAVE.

INDIANA CAVES AND THEIR FAUNA.

BY W. S. BLATCHLEY.

The subcarboniferous limestone area of southern Indiana contains many sink holes and caves within its bounds. This area is, for the most part, embraced in the counties of Owen, Monroe, Lawrence, Washington, Orange, Harrison and Crawford. Going southward from the center of the State, the sink holes first become a prominent feature of the surface in eastern Owen and western Morgan Counties, and are found in numbers thereafter, in the area mentioned, until the Ohio River is reached, beyond which, in Kentucky, they are said to be still more numerous, in

Sink

Holes.

many portions of the State averaging 100 to the square mile.

These sink holes vary much in size, sometimes being but a rod or two across, and again embracing several acres in extent.

They are, for the most part, inverted cones or funnel shaped cavities, and, where small, usually have the sides covered with a matted growth of vines and shrubs. Where larger, trees of varying size are often found growing from the scanty soil on the sides, or from the bottom of the sink. If one will examine closely the lowest point of a sink hole, he will usually find a crevice or fissure through the limestone, or sometimes a large opening which, if it be possible to enter, will be found to lead to an underground cavity—a cave.

Both sink holes and caves not only owe their origin, but usually their entire formation, to the slow, unceasing action of rain or carbonated water upon the limestone strata in which they occur.

Carbon dioxide (CO_2) is present everywhere in the atmosphere, constituting about three parts in 10,000 of the volume thereof. The condensed vapors, falling as rain, unite with a portion of this carbon dioxide, and form a weak carbonic acid or rainwater ($\text{H}_2\text{O} + \text{CO}_2 = \text{H}_2\text{CO}_3$).

*Formation
of Sink
Holes and
Caves.*

This acidulated water, wherever it comes in contact with limestone, brings about a chemical change, calcium bicarbonate, $\text{CaH}_2(\text{CO}_3)_2$, being formed. By this change the limestone is dissolved and carried onward with the seeping or

flowing waters. The action of the rainwater upon the limestone is usually hastened by humic acid, with which the former has combined in passing through decaying vegetable matter before reaching the limestone.

In the beginning of a sink hole, the rainwater seeps through a crevice or joint of the limestone to a lower stratum, along the surface of which it finds a passage. By gradually dissolving the stone, this passage-way becomes increased, until finally a large cavity is formed immediately below the surface. The unsupported weight of the latter causes it to gradually sink downward and assume the inverted cone shape above mentioned. The opening at the bottom becomes larger, allows more water to enter, and a more rapid dissolving takes place between the layers. As soon as the underground passage has become large enough to allow a good-sized stream to enter, the process of erosion or abrasion is added to that of the solvent action of the water, and the enlargement of the passage goes on much more rapidly. This gradual enlargement continues for hundreds, perhaps thousands, of years, and results in a cave, varying in size according to its age, amount of water flowing through it and the softness of the rock dissolved or eroded. The larger caves possess great vaulted rooms, deep pits, high water-falls and streams of water, some of the latter large enough to allow the ready passage of a good-sized boat.

From the above it will be seen that sink holes and caves are closely related, the latter, in fact, being largely dependent upon the funnel shape of the former to collect the surface waters and direct the flow thereof. A number of sink holes often connect by narrow and tortuous channels with the same underground passage, the latter increasing in size with the addition of each new branch, until finally it attains majestic dimensions.

The rooms and passages of limestone caverns are often, subsequent to their formation, partially filled by those handsome forms of crystalline limestone, called stalactites and stalagmites. These are seldom, if ever, formed in great numbers, except where the passages or rooms are relatively close to the surface. The water, charged with carbonic acid, filters slowly through the soil, and, entering the narrow crevices and joints between the layers of stone, seeps downward until it reaches the roof of an underground cavity. Here the slowly dripping water comes in contact with the air of the cave. The liquid is evaporated and the solid particles of carbonate of lime, dissolved from the rocks with which it had come in contact, are left behind. Each successive drop thus deposits or leaves a solid particle until finally a pendent cylindrical mass, called a *stalactite*, and resembling in general form an icicle, remains suspended from the roof.

Where the water thus dripping through the roof of a cavern is greater in quantity than can evaporate before it falls, it drops from the stalactite to the floor below. There it splashes outward and in time evaporates, leaving the solid particles brought down. These accumulate one on top of another until finally a cylindrical or cone shaped mass protrudes upward, slowly growing in size, each successive layer being dis-

tinct from the preceding. This upward rising mass is a *stalagmite*. It is almost always greater in diameter than the stalactite above it. Often the two in time meet, and a column or *stalacto stalagmite* of crystalline limestone results. Down the sides of this the incoming waters slowly flow instead of drop, evaporating and leaving their solid particles as they move, thus increasing in size the diameter of the column. If this action continues long enough, the whole passage or room may be filled by these deposits and all semblance of a cave obliterated. It will thus be seen that water, where it flows freely and rapidly through massive beds of limestone, dissolves and erodes great cavities therein; where it seeps and oozes through such beds, it tends to fill up the cavities already formed. Where the slow flowing water has passed through large masses of pure crystalline limestone, the resulting stalactites and stalagmites are often very clear, almost translucent. Where sediment and mud is carried down with the carbonate of lime, the resulting formations assume a dirty brown and unattractive appearance.

The following figure, with its accompanying explanation, will probably aid in making clear the above statements concerning the formation of limestone caverns:

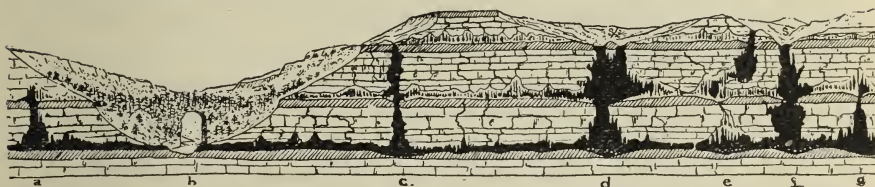


FIGURE ILLUSTRATING THE FORMATION OF CAVES IN LIMESTONE.

S, sink-holes; a, c, d, f, g, rooms in cavern; b, natural bridge formed by the sinking of the roof of a former very large room; e, passages showing numerous stalactites. (After Shaler.)

Many small caves, and doubtless some large ones, exist in southern Indiana whose presence is as yet unknown. In searching for them the bottom of a sink-hole will be the best starting point, the only thing necessary being to blast or dig out the cavity commonly found there, until it becomes large enough to allow a person to enter.

But little has heretofore been written about the caves of Indiana. A number of short descriptions of Wyandotte cave have appeared in the previous geological reports and in various newspapers and magazines; and several of the smaller caves have been briefly mentioned in the reports on the counties in which they occur. A bibliography of such papers will be found at the close of the present paper.

As the Indiana caves are mostly found in the upper strata of the oölitic limestone area, the writer, in June, 1896, decided to visit the more important ones, with the object of making a careful investigation of their more salient features, securing their dimensions and collecting

representatives of the forms of animal life which inhabit them, so that a report concerning them might be prepared and published in connection with an article on the oölitic limestone area, then in course of preparation by Messrs. Hopkins and Siebenthal.

Accordingly a party of five, consisting of Messrs. John B. Peddle,* John S. Michaels, F. H. Blatchley, O. F. Fidler and the writer, started on the 4th of July with the necessary camp equipage, collecting apparatus, etc., in a two-horse spring wagon, for a five weeks' trip of cave explorations.

PORTER'S CAVE.

The first cave visited was in the northeastern corner of Owen County, on the farm of P. Applegate (east half of section 33, township 12 north, range 2 west). The mouth of Porter's Cave is very close to the line between Owen and Morgan Counties, and the source of the stream which flows therefrom is about one-half mile northeast in Morgan County. The cave is little more than a narrow, water worn passageway through the rocks, which at this point consist of St. Louis and Keokuk limestones, the former comprising the roof and the latter the floor. The portion cut out seems to be softer than either and approaches in appearance a dolomite or magnesian limestone.

The mouth of this cave is the most beautiful of any visited. It is in the side of a hill at the head of a narrow canyon, or gulch, which has been eroded by the stream which flows from the cave. From the floor of the cave to the bottom of this gulch the distance is 33 feet, down which the stream flows in a perpendicular waterfall. The mouth of the cave is 50 feet wide and $14\frac{1}{2}$ feet high, the roof extending out in a broadly arched front several feet beyond the face of the waterfall below. The rock down which the water flows is covered with moss, and in the early morn, when the sunbeams light up the interior of the cave for a distance of 75 or more feet, and glisten and sparkle from the mossy background of the falling water, the scene is a most entrancing one.

The cave can be entered only by a narrow footpath on the northern side of the mouth. Twenty feet back from the entrance the roof becomes flat, and for almost 100 feet is comparatively smooth, being composed, apparently, of one immense slab of St. Louis limestone. In this distance the width gradually narrows to 30 feet. The floor is wholly of rock, in some places covered to a depth of several inches with sediment and loose stones brought down by the running stream. The latter for the first 270 feet is from four to eight feet wide and two to five inches deep. It meanders from side to side of the floor, making the frequent crossing of it

*Mr. Peddle at present occupies the chair of drawing in the Rose Polytechnic Institute at Terre Haute, and to him the credit for the photographs and maps of the caves, with the exception of those pertaining to Wyandotte, belongs.

a necessity. Beyond 270 feet it covers the entire floor to a depth of from six to twenty inches, and farther explorations must be made while wading.

The roof after the first 100 feet varies much in character, sometimes being regularly arched with a height of but eight to ten feet; and again very irregular, the sides gradually merging 25 to 30 feet above the floor.

But few stalactites occur in the cave and they are dirty brown in color. At a point 250 feet from the entrance a very large one partially shuts off the passage way, and 645 feet in, a similar one which has had its lower portion broken off, is found. At 750 feet the roof becomes so low that one has to stoop, and the width is reduced to 18 feet. From this point onward both height and width gradually diminish until at 852 feet it became necessary to crawl through water, and further exploration was abandoned. It is claimed that in a dry season persons have passed entirely through the passage, crawling for several hundred feet and then emerging into a low room near the source. A visit to the latter showed that it was not a true sink hole, but a passage-way worn through the rocks in the side of a low hill. The opening was ten feet wide and about four feet high and a short distance back expanded to twenty-five feet in width, but soon narrowed again to eight feet, and 150 feet from the entrance the roof came down close to the water and stopped farther progress. Except to the naturalist there is little attraction about Porter's Cave other than its mouth; but that alone is well worthy a visit by all who enjoy the picturesque and beautiful in nature.

FAUNA. No vertebrates were taken or noted in Porter's Cave except the cave salamander *Spelerpes maculicauda* (Cope), several specimens of which were secured within 200 feet of the entrance. They were clinging to the damp walls of the cave and showed little fear when approached. The raccoon, *Procyon lotor* (L.) visits the cave in numbers and evidently passes entirely through it, as was evinced by the tracks, which were very plentiful along the margins of the stream. To their visitation is probably due the absence of crayfish and other crustaceans, no specimens of which were secured.

Among insects, out-of-door forms were quite numerous, having been drifted in by the flowing water, or else having voluntarily sought shelter within the cave. All the coleoptera or beetles taken were of these above-ground forms, and consisted of six specimens of *Platynus cincticollis* Say, taken from beneath stones within 100 feet of the entrance; one specimen each of *Bradycellus rupestris* Say, *Stenolophus ochropezus* Say, and *Cryptobium bicolor* Grav., each between 50 and 150 feet back, and a single specimen of *Scarites substriatus* Hald., crawling over the mud at 415 feet from the mouth.

Of Diptera a number of specimens were taken from seventy-five feet on back as far as exploration was made. They were found on the sides of the cave and were readily captured. They represented four species,

three of which, belonging to the genus *Blepharoptera*, were afterward found in a number of other caves visited. Of the examples from Porter's cave *B. specus* (11 specimens) and *B. latens* (2 specimens) were new to science and their description will be found in the paper on Cave Diptera, by Mr. J. M. Aldrich, in the present report. The remaining species was *Ulomorpha pilosella* O. S., represented by a single specimen taken 750 feet from the mouth.

One Orthopteron, *Ceuthophilus stygius* Scudd., was captured 250 feet from the mouth, and several others, probably of the same species, escaped beneath some heavy stones. A caddice fly, *Trichoptera* sp., was taken at 750 feet, and had probably hatched from the water flowing through the cave. Two specimens of *Conotyla bollmanii* (McNeill), a true cave myriapod, were taken from beneath stones within 150 feet of the entrance.

Three species of spiders were collected in this cave, as follows: *Nesticus carteri* Em., and *Tmeticus tridentatus* Em., both true cave forms, a single male of the former, 780 feet from the mouth and a pair of the latter at 240 feet; both species crawling over the floor. In the upper end of the cave a half dozen specimens of a small spider were taken which proved to be new to science, and is described by Mr. Nathan Banks in the supplement to this paper under the name of *Theridium porteri*. It was found on the walls or roof and near each specimen was often two and always one small globular cocoon, suspended by a single thread from the roof or a projection of the wall. Scattered threads of webs were also noted, but ran in no definite direction.

The only vegetable form noted in this cave was a fungus, which was branching and ramifying over the rocky wall at 750 feet from the mouth. The same or a similar species was found on some small pieces of drift-wood a short distance further on.

SPRING CAVE

is located in Owen county, about one and a half miles southwest of Porter's Cave, in the (northwest quarter, section 5, township 11 north, range 2 west). A good sized stream flows from a large room, 40 feet wide, 12 feet high at the mouth, and almost 60 feet long; and plunges down a narrow chasm worn in the rock for 25 or 30 feet to the bottom of the ravine below. The single room mentioned was the only portion of the cavern large enough to explore, as the roof gradually lowers and at a distance of 82 feet from the mouth comes down within 18 inches of the top of the water. The only living creature found in the cave was a crawfish, *Cambarus bartonii* Fab., taken from the stream about 50 feet back from the mouth.

MAYFIELD'S CAVE.

This cave is but a long, narrow subterranean cavity, varying in width from 8 to 20 feet. The mouth of it is located 400 yards south of the center of Sec. 26 (Tp. 9 N., R. 2 W.), Richland Township, Monroe County. At the time of our visit the entrance was boarded up, and the first 50 feet was in use as a storage house for milk and vegetables.

But few side passages branch off from the main cave, and they are usually short and narrow. The average height of the main passage is 6 to 8 feet, and there are but few places where crawling is necessary. At 650 feet from the entrance a narrow passage leads down a descent of 8 to 10 feet, and here the first pool of water is found. Several other pools occur at intervals thereafter, but no running stream was present. At a distance of 1,475 feet from the entrance the main passage terminates in a circular room 22 feet in diameter and 7 feet from floor to ceiling. From this room a narrow "corkscrew" passage 288 feet long, 2 feet 8 inches wide and $2\frac{1}{2}$ feet high, runs in a general southwesterly direction. Twenty-nine sharp turns are made in this distance, when it becomes too small for further progress. This passage has been eroded through a stratum of soft shale. The main passage of the cave appears to have been originally filled with a hard, indurated clay, on top of which rests a stratum of oölitic limestone.

FAUNA. No vertebrates were found in Mayfield's Cave. In the pools occurred three species of crustaceans; namely, the blind crayfish, *Cambarus pellucidus* (Tellkam.), a small, shrimp-like form, *Crangonyx gracilis* Smith, and a still smaller species, *Caecidotæa stygia* Packard. But one or two specimens of each were taken. These forms had previously been found in this cave by the late C. H. Bollman, of Bloomington.*

Among insects a small Thysanuran, *Degeeria cavernarum* Packard, was most common, being excessively abundant in damp places on the floor, and especially beneath flat stones in the vicinity of any decaying matter. Several specimens of the true cave myriapod, *Conotyla bollmanii* (McNeill), were taken 275 feet from the mouth, while a single specimen of an above-ground form, *Spirostrephon lactarium* (Say), was found on the roof 506 feet from the entrance.

Of beetles, two true cave forms were here found. A single specimen of a carabid, *Anophthalmus tenuis* Horn, was found crawling rapidly over the side of the "corkscrew" passage, and two specimens of the common cave Staphylinid, *Quedius spelæus* Horn, were secured from beneath a decaying lemon skin, left by some former visitor.

* Packard, "Cave Fauna of N. A.," 1889, 16.

The cave flies, *Blepharoptera latens* and *B. specus*, were frequent on the walls, ceiling, or on flat rocks on the floor. Two or three of the young of the most common spider found in Indiana caves, *Meta menardi* Latr., were also taken. But one half day was spent in the cave, and additional forms doubtless pass their lives therein. Mr. Bollman, according to Packard, *loc. cit.*, found a species of *Machilis* a few rods within the entrance.

TRUETT'S CAVE.

The source or opening of this cave is in a sink hole on a hillside in the southeast quarter of section 4 (township 8 north, range 2 west), about five miles west of Bloomington, Monroe County. The mouth of the stream which has formed it is, as yet, unknown. The opening leading into the cave is very small, and descends rather abruptly for about twenty-five feet. It then expands into a room about sixty feet in diameter, with a roof eight feet high. This room contains many large masses of fallen rock, which occupy much of the space and cause it to appear smaller than it really is. Stalactites are plentiful, but are mostly fragmentary, having been broken by many visitors, the cave being a favorite resort for students from the State University, who wish to get a glimpse of underground life.

At the farther end of this first room the floor descends, and a narrow passway is found leading into a second smaller room. From this another narrow descending passway leads to the main passage of the cave, 280 feet from the entrance. This passageway leads both to the right and left. Taking first the former branch, which is about fifteen feet wide and six feet high, we follow it, stooping at times where the roof comes down to four feet or less, for about 500 feet, where, after ascending a narrow, rugged pass, we find ourselves in the largest room of the cave, 115 feet in length, fifty feet wide, and with an average height of twelve feet. Like the room first entered, this is largely filled with great masses of fallen limestone. In one place these masses extend nearly to the ceiling, and almost separate the room into two compartments. By climbing down the rocks to the lower edge, we find the muddy bed of a stream; but the opening of the passageway leading outward has been choked up, and farther progress is barred. Explorations have in the past been made for two or three hundred feet through this passage, but it is for the most part very narrow and over much of the distance it is necessary to crawl.

Returning to the forks of the main passageway, 280 feet from the mouth, the left branch is entered. For a distance of 150 feet it is six to nine feet high and about twenty feet wide. It then narrows to six feet and the roof comes down to four, until finally, crawling upward through a crevice between fallen rock, we enter a room about twelve feet high,

140 feet long and fifty feet wide, which is partially, in some places almost wholly, filled with fallen rock. The farther end of this room was 600 feet from the entrance, and as no opening large enough for passage leads onward from it, we retraced our steps, leaving the room by a pit-like hole fifteen feet deep, which opens into the main passage thirty feet back of the narrow crevice through which we had crawled into the room.

The only water found in Truett's Cave at the time of our visit, July 9, was in shallow, isolated pools in depressions in the lowest parts of the floor of the main passage. The cave seems to be more recent in its origin than many visited, though the stream which originally formed it has disappeared or sunk to lower levels for its passage way. It presents no scenes of interest, except those of the rugged masses of fallen rock in the main rooms.

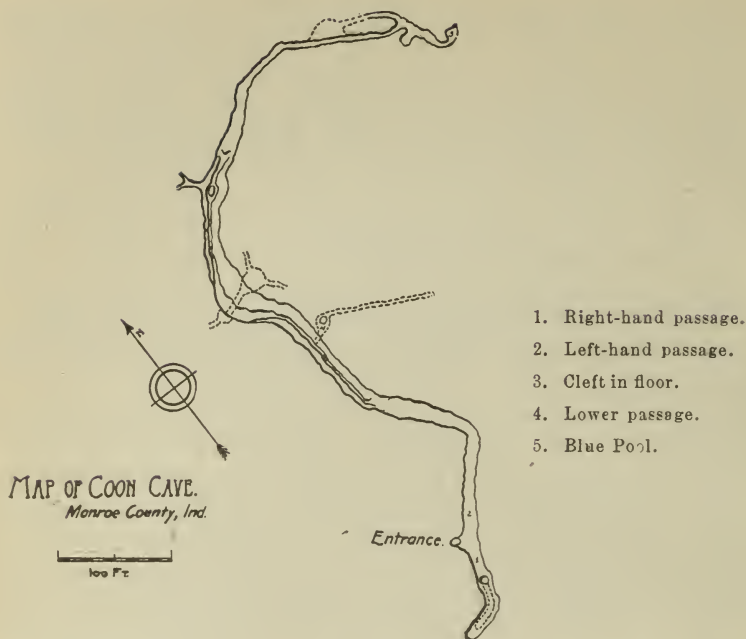
FAUNA. No vertebrates were found in Truett's Cave, though signs of raccoons, mice and bats were plentiful. On account of the absence of water, crustacean life was wholly unrepresented. Of myriapods, the true cave form, *Conotyla bollmanii* (McNeill), was common beneath stones and pieces of wood, from 400 feet onward. The Thysanuran, *Degeeria cavernarum* Pack., was also abundant in damp places on the floor. The small spider, *Theridium porteri* Banks, was frequent about the walls and ceiling of the first room entered. One blind beetle, *Anophthalmus tenuis* Horn, and several specimens of the cave staphylinid, *Quedius speleus* Horn, were found about the decaying remains of a feast in the left main passage, 500 feet from the entrance. Here, also, were found two specimens of an Aleocharinid beetle, which was not collected elsewhere on the trip.

Two species of Diptera were taken from Truett's Cave, namely, *Macrocera hirsuta* Loew, recorded heretofore only from the District of Columbia, and *Limosina tenebrarum*, a new species described by Prof. Aldrich in a supplemental paper to this report. These constituted the only animal forms collected, though, doubtless, protracted searching would disclose a number of other inhabitants of the cave.

COON'S CAVE.

The entrance into this cave is a perpendicular pit or well, forty-six feet deep and about six feet in diameter. The top of this pit is at the bottom of a rather shallow sink hole in the southwest quarter of section 8 (township 8 north, range 2 west), about seven miles west and two miles south of Bloomington, Monroe County, Ind.

The cave, like Truett's, Mayfield's and Blair's, is in the upper or blue stratum of the St. Louis limestone. This stratum underlies the Clinton sandstone and overlies the true oölitic stone of the St. Louis formation.



The descent into the cave was made by a rude ladder which had been constructed of poles by some previous explorer. At the bottom of the pit one finds himself on the edge of a passageway, about ten feet high and nine feet wide, which extends both to the right and the left. The right hand passage is but about ninety feet long, the roof and floor gradually converging and being but a foot or so apart at that distance. Thirty-five feet from the entrance is a hole in the floor of this right hand passage, through which one can be lowered by a rope fifteen feet to the floor of a lower passage, twenty-five feet long, ten feet high and six feet wide, which extends nearly parallel to the passage above. By the side of a smaller opening is a stalactite, seven feet, six inches long and five feet five inches in circumference, suspended from the bottom of the upper floor into the passageway beneath.

The left hand passage comprises the greater portion of the cave. It varies in height from four to twenty feet, averaging about eight. But little stooping or crawling is necessary, but much climbing over rough stones and up and down steep, rugged slopes has to be done, the floor in most places being covered with great masses of fallen rock. Two hundred and forty feet from the entrance a crevice leads off through the walls on the right. By crawling along a ledge of projecting stone for about 100 feet, we reach the edge of an opening large enough to admit the body of a man, and by aid of a sapling, bearing numerous short.

prongs or remains of limbs, which we found in place, we descended twenty-eight feet into a lower passage, about sixty feet long and ten feet wide. Here we found some shallow pools of water, but no living forms, and nothing in the way of scenery to reward us for the labor of getting down and up.

In numerous places the floor of the main passage has a deep cleft near its center or on one side, varying in depth from eight to twenty feet, and in width from a few inches to three feet and more. In several other places, notably 340 feet from the entrance, are openings or deep pit-holes, similar to those already mentioned leading down into lower passages, the latter, however, of small extent. The main passage begins to narrow about 575 feet from the entrance, and 100 feet farther on is but three feet in width. At this point a branch turns to the left and leads downward into a lower room of small size. A short distance beyond this branch the main cave ends in a small crescent-shaped room, in the farther end of which, 750 feet from the entrance, is a deep crevice in the floor, filled with the most limpid water that had ever been seen by any member of the party. This pool of water was four feet wide and appeared but three or four feet deep, but actual measurement showed it to be nine feet, three inches in depth. The length of the pool could not be determined, but it extended down a branch passage to the right, covering all the floor thereof as far as one could see. For two or three feet above the water-line the walls of this room are covered with small but most beautiful crystals of calcite, which reflected the light of our candles in a most brilliant manner. Numerous small stalactites of the clearest crystal stud the walls and project from the crevices of the roof, while the floor is largely composed of calcite, derived from the overflow and subsequent evaporation of the water from the pool. This room is, in truth, a fairy grotto, decked with jewels resplendent, and a view of it will well repay for all the time and toil necessary to step within its bounds.

FAUNA. Bats were the only vertebrates found in Coon's Cave. Here and there a single individual hung head downward from the roof, but all were of the single common species, *Vespertilio subulatus* Say. In winter they must occupy the cave in large numbers, judging from the amount of their excrement noted within its confines. No crustaceans were found, and of myriapods but a few dead specimens of *Conotyla bollmanii* were noted.

A single specimen of an unknown beetle belonging to the family Silphidæ was taken from beneath a stone 150 feet from the entrance, while of the common cave staphylinid, *Quedius speleus* Horn, three specimens were secured. The Thysanuran, found in most of the Indiana caves, was plentiful in damp spots on the floor. One species of fly, *Blepharoptera pubescens* Loew, represents the Diptera taken, though *B. latens* and possibly *B. specus* were seen. Of spiders, two species, *Nesticus carteri* Em.

and *Meta menardi* Latr., were the only ones found, and complete the list of animals noted within the cave.

STRONG'S CAVE.

The entrance to Strong's Cave is situated near the center of the north-east quarter of section 34, Richland Township, Monroe County, and about three-quarters of a mile northwest of the Cross Roads church, which is four miles west of Bloomington. The mouth of the cave is about 200 yards west of two sink holes, which carry off the surface water of perhaps one square mile of territory. This water in time finds its way through the lower levels of Strong's cave to Strong's spring, one-half mile west.

The entrance to the cave has the external aspect of a sinkhole. Descending into this one finds himself in a small room, with a passage leading on in the general direction of the cave, and another one at right angles leading downward a distance of about 20 feet to running water. The water comes from the direction of the sinkholes referred to above, and goes by a lower, impassable channel in the general direction of the cave.

From the room near the entrance, after crawling along a low, flat passage for 70 feet and descending a declivity, one enters a large room 50 feet long, 15 feet high and from 15 to 25 feet in width. This room contains on the west side some handsome stalactites, and beneath can be heard the murmur of running water.

Beyond this room is the most interesting portion of the cave, a room 20 feet long, 20 feet high and 25 feet wide. The floor is quite inclined, so that the farther end reaches the water level and contains standing water. At the junction of this room with the one just described is a passage 14 inches in height, which opens upon a shelf in the side wall about five feet from the floor and leads off through a maze of pillars and stalactites. The feature of this room is the beautiful "Hanging Garden." This is upon the west wall of the room, and consists of such a wealth of pillars, columns, flutings, stalactites, stalagmites and botryoidal concretions as to require no great stretch of the imagination to see fruit, flowers and statuary.

From the room of the Hanging Garden one passes by stooping and crawling over mud, gravel and running water through a passage 10 to 12 feet wide and varying from 6 feet to 30 inches in height, with a flat roof covered with innumerable "needle" stalactites, of whose existence one is often made unpleasantly conscious, for a distance of 257 feet to the Star Chamber.

This room is 60 feet in length, 8 feet in height, with a flat roof, 15 feet in width at the near end and $28\frac{1}{2}$ feet at the farther end, where it is cut



THE "HANGING GARDEN," STRONG'S CAVE, MONROE COUNTY, INDIANA.



squarely off by an even wall. The stream which runs along one side of the room finds its way beneath this wall and pursues its course to Strong's spring, a half mile distant. The smooth, square dingy walls of this room, the lack of cave detritus, the oppressive silence, all go to make the name Star Chamber an appropriate one. The grime upon the walls shows that this room, as well as the whole passage back to the lower part of the room of the Hanging Garden, is flushed with water during the rainy season.

Near the entrance to the Star Chamber is another passage that leads back toward the mouth. It is from six to twelve feet in width and from three to eight feet in height. It rises in the direction of the mouth of the cave, and after tortuous winding among pillars near the mouth opens out upon the shelf at the nearer end of the room of the Hanging Garden, thus making a complete circle underground. The cave in all as described above measures 667 feet in length.

FAUNA. Above-ground vertebrates visit Strong's cave in numbers, as evinced by their tracks. A raccoon or mink, in his subterranean prowlings through the low, wet passageway beyond the Hanging Garden, was disturbed by us and a great splashing of water resulted. No blind crawfish were found and but one seeing one, *Cambarus bartonii* Fab., which seems to have a liking for underground life, having been secured in a number of caves. One other crustacean, *Cæcidotæa stygia* Pack, was found in small numbers in the stream nearest the entrance.

The cave cricket, *Ceuthophilus stygius* (Scudd.), was represented by several immature specimens taken from among the pillars and stalactites in the passageway leading back from the "Star Chamber." The cave spider, *Meta menardi* Latr., was common in the cave, the individuals varying much in age and size. No flies or myriapods were secured, though specimens of a form of *Blepharoptera* were noted.

ELLER'S CAVE.

The entrance of this cave is at the bottom of a sink hole, 100 feet in diameter, in the southwest quarter of section 15 (township 8 north, range 2 west), Monroe County. The cave itself is a double floored one, the upper and older floor being dry, and the more recent and lower floor having a stream of water flowing through the greater part of its length.

The entrance, about six feet wide and six and a half high, descends gradually for about fifty feet, and there expands into a room twenty feet wide, thirty feet long and twenty-five feet high, which serves as a vestibule or starting point for both floors, the entrance to the upper one being in the wall, about eight feet above the floor.



Two passages lead from this vestibule into the lower floor, one to the right through a narrow winding cleft in the rock, and then down to the bed of a stream, along which, by crawling, we advance, until we come out into the second passage, fifty feet from its starting point. From here onward for 210 feet the lower passage leads through a water-worn crevice from two to four feet wide and three to fifteen feet high, the stream sometimes covering its bottom, and again running in a channel cut beneath one or the other of the sides. Three hundred feet from the cave entrance this passage ends abruptly in a room fifty feet high and ten feet wide, the sides converging in an angle to form the roof. On the left, about twelve feet from the floor, is an arched opening, and through it comes a roaring sound of falling water. With difficulty we climb a slippery bank, and, passing through this opening, find a most magnificent scene for so small a cave—a great cylindrical pit or shaft, twenty feet in diameter and sixty feet high, down which, on the farther side, falls a stream of water. A large bowl shaped cavity twelve feet deep has been worn by the falling water in the limestone below the level on which we stand. Descending into this, we find that the stream flows out through a passage to the left, too low for exploration.

Returning to the vestibule we climb to the entrance of the upper floor, and, passing a short distance within it, find two passages diverging. One to the left, but forty feet in length, ends blindly against a bank of hard clay. Here had been, in days of yore, a bear wallow, and the marks of bruin's claws were numerous and plainly visible in the clayey walls. The right hand passage proved a long and tortuous one, and had a number of short branches leading from it, one of which showed plainly the evidence of former inhabitancy by bears. This main upper passage is in most places seven to ten feet high, with a width of five to seven feet. Two hundred feet from the vestibule it became necessary to crawl for about thirty feet through a space one foot high by two feet wide, when we emerge into a circular room thirty feet in diameter by three and a half high, the floor of which contains a vast amount of bat guano. Beyond this the passage forks into three branches, each of which was explored as far as possible, the longer one reaching 400 feet from the vestibule before its small size barred farther progress. The floor of this upper cave was covered in many places with a yellow ochery clay. In this, in several places, were found some handsome acicular crystals of selenite. No water was found on the upper floor, except at the farther end of the galleries where it stood in shallow pools. These places were evidently quite near the outer surface, as the shells of several land snails were found near by the water.

FAUNA. No vertebrates were seen in Eller's Cave, though, as in many others visited, the signs of out-of-door mammals were plentiful.

Of crustaceans, two species, *Crangonyx gracilis* Smith, and *Cacidotæa stygia* Packard, were found in small numbers at several localities in the stream of the lower floor. No myriapods nor adult beetles were noted, though near the end of the upper gallery a number of the larvæ of *Quedius speleus* Horn, were found beneath a pile of the excrement of raccoons. Some half grown specimens of *Meta menardi* Latr. represented the spider family. Thysanurans, *Degeeria cavernarum* Packard, were plentiful, while of Diptera, a number of specimens of *Blepharoptera specus* Aldrich, were secured. For a cave as well watered as it is the fauna was exceedingly limited, though a longer stay would doubtless have revealed a number of additional species.

SALTPETRE CAVE,

Monroe County, is located in the northwest quarter, section 15 (township 8 north, range 2 west), about six miles southwest of Bloomington. The cave has a rather large entrance, it being twenty-five feet wide and four and a half feet high, with the floor descending for twenty or more feet. Fifty feet in it narrows to eight feet in width, and 150 feet from the entrance the roof comes down to within three feet of the floor, and a ditch

has been dug for a distance of forty feet to facilitate passage to the large room immediately beyond. This room is fifty feet wide by sixty feet long, with the roof flat and the floor on the farther side sloping down at an angle of about forty-five degrees to a deep hole, called the Devil's Pit, which has a diameter of twenty-three feet, with the bottom thirty-five feet below the main floor of the room. From this pit one passes onward through an arched doorway into a narrow passage twenty feet high and five feet wide, between great masses of limestone. In one place this passage is partly filled by an enormous mass of fallen rock, over which one has to climb and descend on the farther side by a rude ladder, or, rather, pole with slats nailed across it. Beyond this the passage narrows into a crevice forty feet high and three feet wide, and finally enlarges into a small room, from which a low water passage alone extends. The entire length of the cave admitting exploration is thus but about 400 feet. Retracing our steps toward the mouth, we find on the right side of the main room an opening near the top, which leads into an alcove or small circular room, twenty feet in diameter and ten feet high, the floor being about on a level with the ceiling of the large room adjoining. The walls of the small room have an intercalary stratum of shale between two layers of limestone. In many places the lower stratum of limestone has dissolved away and the shale has decomposed into a soft unctuous clay containing many fine crystals of selenite. The large room of the cave has its floor partially covered with a deposit of "nitre earth," or red clay, which by lixiviation yields about 6.5 per cent. of potassium nitrate. In the early settlement of the country this deposit is said to have been utilized and the nitrate used in the making of gunpowder, whence the name of "Saltpetre Cave."

FAUNA. No water was found in the cave, hence animal life was scarce. A few specimens of the "little brown bat" were seen clinging to the ceiling, and the dens and characteristic odor of foxes were noted in several places. The Thysanuran was plentiful in a few of the damper spots on the floor. Of Diptera, but two species, *Blepharoptera pubescens* Loew and *B. specus* n. sp., were found on the walls, while a few specimens of the most common cave spider, *Meta menardi*, was the sole representative of the Arachnida. No beetles, myriapods or crustaceans were seen.

SHILOH CAVE.

The entrance to this cave is at the bottom of a sink hole a few rods north of Shiloh Church (northwest quarter section 18, township 5 north, range 1 west), about seven miles northwest of Bedford, Lawrence County. Except after a heavy rain, no water flows through the entrance, but a stream runs the entire length of the main cave, entering it from beneath a great mass of fallen rock which has partially closed the entrance, and meandering from side to side on the floor in its onward course. On entering, one descends rapidly for about twenty-five feet, and then reaches the general level of the main passage. This passage is from fifteen to twenty-five feet high and about the same width for 2,000 feet, which was as far as it was explored, the water becoming too deep to wade beyond that point. It far exceeded any of the previous caves visited in the number and size of its stalactites and stalagmites, many of which were of exceeding clearness. In the words of Prof. John Collett, who visited the cave in 1873, "the lofty sides are draped and festooned with stalactites, sometimes hanging in graceful folds or ribbed with giant corrugations. Above, the roof and overhanging sides bristle with quill-like tubes, fragile as glass, each tipped with a drop of water which sparkles in the lamplight like a crystal jewel."

Three hundred feet from the entrance three jets of water pour down from the right wall of the cave, and add to the size of the stream along its floor. These falls vary in height from seven to ten feet, and together they produce a roaring sound which is echoed far along the main passageway.

From this point onward the walls are dripping more or less and are fringed with small stalactites. About 900 feet from the entrance are two large stalagmites, one of which, named by Collett "The Image of the Manitou," has been broken. Originally it must have been six feet in height and eighteen inches in diameter.

Several branches leave the main passage but all but one are short in length. The one exception turns to the right about 1,500 feet from the entrance and extends in a southwesterly direction. At first it is a high, narrow fissure with the jutting walls bearing many stalactites. A stream of water covers the entire floor, and from far in the distance comes a murmuring sound caused by a succession of water falls, four in number and in size small, which occur at short intervals along the passage. Wading through pools, clinging to corners of jutting ledges, climbing over slippery, perpendicular banks we make our way until finally the passage begins to rise, and the limestone gives place to a dark shale, and this in time to a light colored clay. We are 900 feet from the fork and think we are nearing the surface and will soon find our way above

ground, when all at once our lights go out and we stagger backward through utter darkness, escaping, as if by a miracle, the clutches of the deadly choke-damp which lurks for unwary explorers amidst the deepest recesses of this cave.

Beyond the point where this right branch leaves it, the main passage continues in a southerly direction and was explored until the back water from the dam at the mouth of the cave became too deep to wade. As we were preparing to leave the cave a heavy thunder shower came up, and the water soon poured in torrents through the sink hole, and adding its volume to that of the enlarged stream within the cave, soon covered the entire floor to a depth of nearly two feet.

Leaving the cave after the shower had subsided, a visit was made to the mill at its mouth. This is located in one of the ravines or breaks of Salt Creek, about two-thirds of a mile south of Shiloh Church. Here a heavy wall of masonry has been built across the mouth of the cave, which is on the hillside, forty feet above the mill. This dams the water back until it entirely fills the cave for quite a distance. In wet seasons the water is sufficient to grind full time, but in dry seasons the mill often has to be shut down for several days to allow the water to "head up."

FAUNA. Professor Collett reported the animals inhabiting Shiloh Cave as "coons, rats and ant-lions." None of these were seen by the writer, nor were any vertebrates noted. Of crustaceans, the blind crayfish, *Cambarus pellucidus* (Tellk.), was quite common in the pools of the stream flowing through the cave. Two small aquatic Hemiptera-Heteroptera of the genus *Corixa* were taken, by dredging, about 350 feet from the entrance. These were the only specimens of Hemiptera taken in Indiana caves.

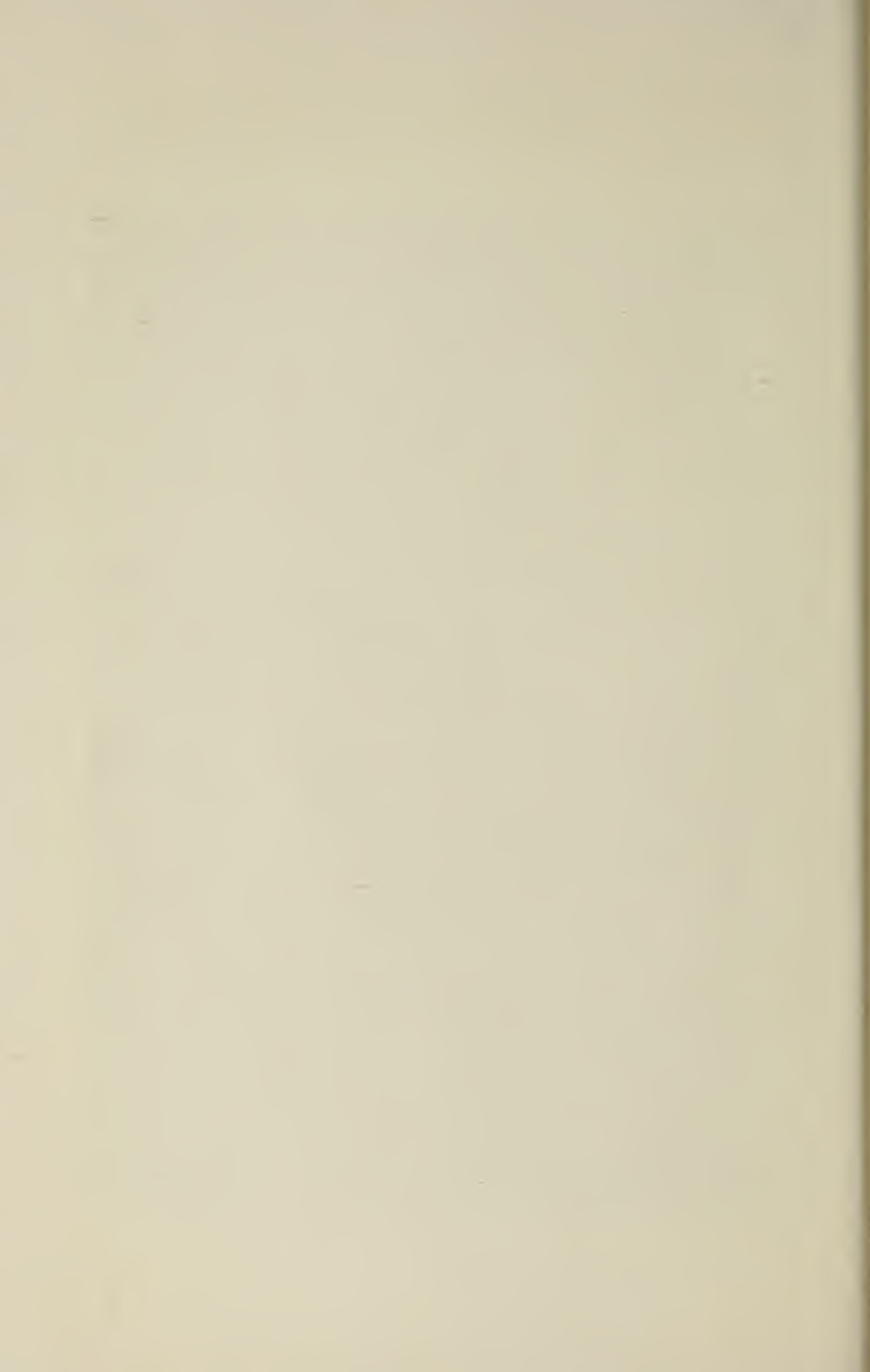
A single specimen of the true cave beetle, *Anophthalmus tenuis* Horn, represented the Coleoptera; while of Diptera, *Blepharoptera pubescens* Loew, and two new species, *B. latens* and *Mycetophila umbraticus*, were secured. A single myriapod, *Lithobius* sp. ? and a stone cricket, *Ceuthophilus maculatus* (Harris), completed the living forms noted in the cave.

DONNEHUE'S CAVE.

The mouth of this cave is located near the foot of one of the bluffs of White River, 500 yards distant from that stream and two and one-half miles southwest of Bedford, Lawrence County, in the southwest quarter of section 27 (township 5 north, range 1 west). From the mouth of the cave a small stream finds its way, the source of which is in a sink hole three-fourths of a mile distant in a northeasterly direction. The stream is greatly enlarged after a heavy rain, and by its erosive action the cave is constantly but slowly increasing in size.



THE ENTRANCE TO DONSEHUE'S CAVE, LAWRENCE COUNTY, INDIANA.





Entering the cave, one finds himself in a commodious room, 10 feet high and 48 feet in width, the floor of rock, covered in places to a depth of two or three feet with alluvial drift. Fifty feet back this narrows to 12 feet in width, and a short side passage puts off to the left, in which a number of the cave salamanders were found. Back 180 feet from the mouth, the passage was $6\frac{1}{2}$ feet high by $6\frac{1}{2}$ feet broad, the stream on the floor about three feet in width and three inches deep. Farther on this stream deepens and several pools were found in which the water was two or more feet in depth. At a distance of 325 feet the

main passage forks, and from the right-hand branch so strong a current of air came that it was impossible to use candles and lanterns had to be substituted. The change in lights made, the right-hand passage was found to be a narrow, winding one, about 150 feet in length, and to lead back into the main passage about 100 feet farther from the mouth than the point from which it started. All these branches are through the solid rock, and are only water channels, three or four feet high and about as wide.

Beyond 425 feet, several side branches were found to contain water too deep to wade, or to soon become too low for further progress; in fact, the rock is more honeycombed with small passages than in any cave visited. The main passage, however, at about 500 feet from the mouth, enlarges to a height of 40 feet and a width of eight to ten. This portion is for the most part dry, the stream having disappeared in one of the low channels already mentioned. In some places two floors are found, in others the greater part of the upper floor has fallen in, leaving a portion in the form of a natural bridge, spanning the passage from side to side. At a point 950 feet from the mouth the upper passage ends against a perpendicular wall of rock, from near the top of which was a passage onward, but too high from where we stood to admit of entrance. The

lower passage was followed to about the same point, where it became two feet high and three feet wide and almost filled with water, thus barring further progress. But few stalactites are found in the cave, and they are mostly of small size and unattractive appearance.

FAUNA. The cave salamander, *Spelerpes maculicauda* (Cope), was found to be more abundant in this cave than in any previously visited. Several were back 300 feet or more from the mouth, though most were taken about fifty feet therefrom. No bats or other mammals were noted, though tracks of raccoons and minks were plentiful. Although the conditions for aquatic forms seemed most favorable, with the exception of the single shrimp-like crustacean, *Crangonyx gracilis* Smith, none were seen. Blind crawfish had been previously found in this cave by W. P. Hay, but the raccoons, or something else, had caused their total disappearance in those portions of the cave explored by us. Of spiders, one species, *Meta menardi* Latr., was very plentiful; and of Diptera, four species were taken, as follows: *Sciara* sp?; *Blepharoptera latens* and *specus*, two new species described hereafter by Aldrich; and *Limosina tenebrarum*, also new to science. This last species was found in company with a number of the larvæ of the cave staphylinid, *Quedius speleus* Horn, inhabiting a large pile of coon dung in a recess of the cave, 350 feet from the mouth. Here also were taken a number of specimens of the mature beetles *Quedius fulgidus* Fabr. and *Q. speleus* Horn, as well as an earthworm as yet undetermined. No myriapods or thysanura were noted in the cave.

HAMER'S CAVE

has its mouth on the side of a hill at the head of a deep valley in the southeast quarter of section 32 (Tp. 4 N., R. 1 E.) three miles east of Mitchell, Lawrence County. Near the head of this valley and close to the mouth of the cave are the ruins of an old stillhouse and a large deserted stone mill, both of which were formerly run by the stream of water which rushes with great force through the mouth of the cave fifty feet higher on the hillside. At the time of our visit the dam at the mouth of the cave was still intact and the water behind it filled the cave to a depth of four feet or more, so that exploration was impossible. From the mouth and through a wooden flumeway extending to the mill, the water was rushing with great speed. According to Prof. Collett (Ind. Geol. Survey, 1873, 303), the floor, a short distance within the cave, was at that time "level, six feet wide and covered with a swift stream of water eight inches deep, although at places the depth is increased to twenty feet. A boat of course is needed for exploration. Three-quarters of a mile* from the door is the first fall. The whole stream rushes down an incline only three feet wide with great violence

*Distance guessed at and probably not over 250 yards.—W. S. B.

and a noise that fills the cave. The boat must be carried above this obstacle, when another voyage is taken along a space of 300 feet to the second falls or 'grand cascade.' Beyond, the cave is low, wet and full of rushing water, which flows out of a crevice in the rock. Eyeless fish, crawfish and other crustaceans are found in this and the two adjoining caves which have outlets in the grand amphitheater in which the mill is situated."

DONNELSON'S CAVE.

Among Indiana caverns the mouth of Donnelson's Cave ranks next to that of Porter's in picturesque beauty. Indeed, by some it is classed as more attractive. The mouth of the cave is found at the head of a deep gorge worn through the limestone by a good sized stream which flows from the cave and down the gorge to the broader valley beyond. Many centuries ago the cave extended the full length of the gorge, and the waters of the stream flowed directly from its mouth into the valley. The roof of the underground channel finally became so thin that it collapsed, the gorge was then started, and as the centuries went by grew in length, the cave ever becoming shorter by the continued falling of the roof. Both gorge and cave are located in the southeast quarter of section 33, township 4 north, range 1 east, about three-fourths of a mile east of Hamer's mill.

Three passages open directly into the mouth of the cave. The right hand passage has the level of its floor about five feet above that of the entrance, while the opening on the left is 12 feet above the bed of the stream and very difficult to enter without a ladder. The middle passage extends straight back from the common vestibule or main entry. The latter is twenty-five feet long, twenty-one feet high and eighteen feet wide, but at its farther end is reduced to the narrow middle passage between great masses of limestone. The water in this passage is waist deep and explorations must be made by wading or in a light canoe. One hundred feet within is a magnificent cascade, where the stream rushes and leaps down a narrow passage with such violence that the noise is plainly heard at the entrance.

The right-hand passage for the first 100 feet is about ten feet high by fifteen wide, with a clay bottom and a roof on a level with that of the vestibule. It then expands into a large room, 230 feet long and forty feet wide, which lies east and west at right angles to the entering passage. This narrows at the west end to twenty feet, and at one point the outer air flows in through a small opening in the roof. From near the small end of the room a narrow passage starts off to the southward and can be traveled for 200 feet, when it becomes too small for further advance. Along this passage a small stream flows, disappearing through a

hole in the floor near the entrance to the larger room. Other than this, both right and left passages leaving the main entry are dry.

The passage at the left of the main entrance to the cave is about 150 feet long by twenty broad, and contains no points of especial interest. No stalactites worthy of notice are found in this cave. It is said that about the year 1800 the nitrous earth on the floor of the two dry passages was used in the making of saltpetre; and the stream flowing from the main cave was afterward dammed and utilized in driving a woolen, grist and saw mill.

FAUNA. The blind fish, *Amblyopsis spelæus* DeKay, is said to inhabit this cave, but none were taken or seen by the writer, though a number were secured in a near-by cave, which probably is connected with this.

Among crustaceans, the blind crayfish, *Cambarus pellucidus* (Tellk.), and the small *Cæcidotea stygia* Packard, were secured. Of spiders, two forms, the common *Meta menardi* Latr., and an above-ground species, *Dolomedes urinator* Hentz, were taken. Of flies, two species of *Blepharoptera* were seen on the walls of the dry rooms. No beetles or myriapods were taken.

CLIFTY CAVES.

The mouths of the two Clifty caves are about 200 yards apart, and are located at the head of a deep and narrow valley in the east half of section 14 (township 3 north, range 2 east), about three miles north of Campbellsburg, Washington County, Indiana. Clifty Creek has its source in the streams which emerge from the caves, and flows in a north-westerly direction about four miles to White River, into which it empties. Its valley, especially the upper half, is noted for the wild and rugged scenery, and the vicinity of the caves is a noted resort for pleasure seekers.

The caves are designated, respectively, by the terms "wet" and "dry," the former being the smaller of the two. Across the mouth of the wet cave a dam has been built, and the water emerges from it in sufficient force to turn the machinery of a distillery and grist mill, both abandoned, however, since their owner died, a few years ago. The mouth of the cave is a perfect archway in the solid limestone, fourteen feet wide and eleven feet from roof to bottom. The water behind the dam was two and a half feet in depth, and deepened rapidly as one went back, and the cave was explorable only by boat, which we did not possess.

In Packard's "Memoir of the Cave Fauna of North America," p. 16, is an extract from a report on a visit to these caves by Dr. John Sloan, of New Albany, in which he states that he went up the stream in the wet cave for about 200 yards on a raft of timber, at which point rapids were encountered, over which it was impossible to lift the raft, and the water above being too deep to wade, he was obliged to return.

The "Dry Cave" was explored by our party for a distance of 2,650 feet, beyond which it was impossible to proceed.

The entrance is larger than that of the wet cave, being eighteen feet high and twenty feet wide. Back 100 feet it narrows to thirteen feet in width, and, fifty feet farther, to about eight feet, the water at this point covering the entire floor to a depth of six inches. For the first 500 feet the main passage is very crooked, but beyond that point it is comparatively straight and extends in a general south-westerly direction. Like Mayfield's cave, it is a mere water-worn passage, with no large rooms, few stalactites, and, in general, may be said to be monotonous. The stream on the floor winds from side to side of the cave, thus making the frequent crossing of it necessary.

Several short side branches diverge from the main one, and at a distance of 1,300 feet from the mouth a larger branch turns off to the right, which was explored for about 400 feet, but not to the end, as our time was limited. The main passage continues to the left, and at 1,800 feet we found a large rock, 30 x 15 feet, which had fallen from

MAP OF CLIFTY CAVE.
Washington County, Ind.



the roof and partially blocked the way. Two thousand feet from the entrance the passage widens into a room 100 feet across and four feet in height, which contains much fallen rock, but nothing else of especial interest. Beyond this the cave narrows again and varies from twenty to thirty feet in width, as far as explored.

FAUNA. Dr. Sloan states, *loc. cit.*, that blind fish are found in the "Dry Cave," but, though especial search was made for them, none were seen. Several cave salamanders, *Spelerpes maculicauda* (Cope), were taken from the damp walls within 100 feet of the entrance. Bats were

seen in small numbers hanging from the roof, and signs of "coon" were plentiful.

One blind crayfish, *Cambarus pellucidus* (Tellk.), and a large number of seeing ones, *C. bartonii* Fab., represented the crustaceans, both forms being taken from the same locality, about 1,200 feet from the mouth. No myriapods or thysanura were seen. Of Arachnida, the cave spider, *Meta menardi* Latr. was common, hanging from a single thread attached to the roof; and a few specimens of the cave harvestman, *Scotolemon flavescens* (Cope), afterward found abundantly in Wyandotte Cave, were secured. Several young and one mature specimen of the cave beetle, *Quedius spelaeus* Horn, were taken from some refuse matter, 600 feet from the entrance, and a representative of that common above-ground carabid, *Harpalus pennsylvanicus* De Geer., was taken by the side of the stream flowing through the left branch, 1,400 feet from the entrance. It had probably been washed in by some of the heavy rains the week before. The only additional forms taken were Diptera, three species of *Blepharoptera* being found on the walls, and a small gnat-like form, *Limosina tenebrarum*, n. sp., from some refuse matter, 600 feet from the mouth.

MARENGO CAVE.

This cave, which next to Wyandotte is the most noted in Indiana, is located in the northwest quarter of section 6 (township 2 south, range 2 east), a short distance northeast of Marengo, Crawford County. The L. E. & St. L. Railway ("Air Line") passes through Marengo, and the entrance to the cave is less than one mile from the station.

Marengo Cave has been known only since 1883, and the owners of the land on which the entrance is located, were wise enough to prevent the ruthless destruction of the stalagmites and stalactites which form the main beauty of the cavern. Some children playing about a sink hole in September of that year, noted an opening which had been formed near its bottom by a recent falling of earth and rock, and, venturing in, found the room now known as "Grand Entrance Hall." Afraid to go farther, they made known their discovery to other persons, and in a few weeks the entire cave had been explored. A building was soon afterward erected above the mouth, and stairways built, so that entrance into the cave could be easily and safely made.

Thousands of visitors have since passed through the cave, and no one who is at all in sympathy with nature can come forth from its corridors and passages without feeling fully repaid for his peep into one of her underground chemical workshops. There the only materials necessary are water and limestone. Given these and time unlimited, and the varied character and wonderful beauty of the products possible can only be realized by those who have spent a few hours in a cavern like Marengo.

Descending the stairway, after having been provided with a lantern and guide, the visitor finds himself sixty feet below the surface in the large vestibule known as the Grand Entrance Hall. This is a room 50 feet wide, 20 to 30 feet in height, the floor of dry earth, and with two passages diverging, one ascending to the right and leading through the Short Route and Crystal Palace, the other descending to the left and leading through the Long Route.

Taking first the latter, we find the main passage to be 12 feet high and about 50 feet wide. Scattered at intervals along its walls and roof are many stalactites, some in groups, others singly, and all possessed of fanciful names given them by former visitors or by the proprietors and guides of the cave. One hundred feet from the foot of the entrance is a slab of limestone, fallen from the roof, whose dimensions are 18 x 8 x 4 feet. This is known as Fallen Rock, and beyond it a short distance is, on the right, a passageway known as the "Cut Off," which leads to the Crystal Palace. Continuing, the main passage widens to 30 or more feet, and for a distance of 80 feet is known as Statue Hall. In it are some noteworthy formations, the prettiest of which is Mt. Vesuvius, a large, rounded stalagmite. Above it is a group of slender stalactites, down which a stream of water trickles and gives a muddy character to the floor for a distance of several hundred feet. From the side of the roof, on the right, hangs a group of stalactites, their bases thin, wide and overlapping, the whole resembling



1. Grand Entrance Hall.
2. Cut Off.
3. Congress Hall.
4. Mammoth Hall.
5. Elks' Hall.
6. Music Hall.
7. Cave Hill Cemetery.
8. Creeping Avenue.
9. Junction Room.
10. Fairy Palace.
11. Prison Cell.
12. Prison Bars.
13. Washington Avenue.
14. Lovers' Retreat.
15. Nameless Pass.
16. Crystal Palace.
17. Crystal Palace Gallery.
18. Pillared Palace.
19. Western Avenue.

somewhat a bunch of "long green," whence the name of "Tobacco Shed" given to this formation.

Congress Hall succeeds Statue Hall, and contains along the edge of the ceiling some handsome formations, known as the Giant's Mitten, Mammoth Pen, etc. From this hall the bed of an old stream leaves to the right beneath the massive limestone walls. Mammoth Hall, with a width of about sixty-five feet and a length of 300, comes next in order, and contains the Elephant's Head, Folded Lamberquin, Bridal Curtains and other fantastic formations of carbonate of lime, wrought in darkness in ages past.

Beyond Mammoth Hall the passage divides and passes around a mass of uneroded limestone. The branch on the right rises ten or fifteen feet above the level of the main floor and enlarges into Elk's Hall, a room 190 feet long and twenty feet high, which was dedicated and named, as an inscription on the walls informs us, by Louisville Order, No. 8, B. P. O. E., September 27, 1885.

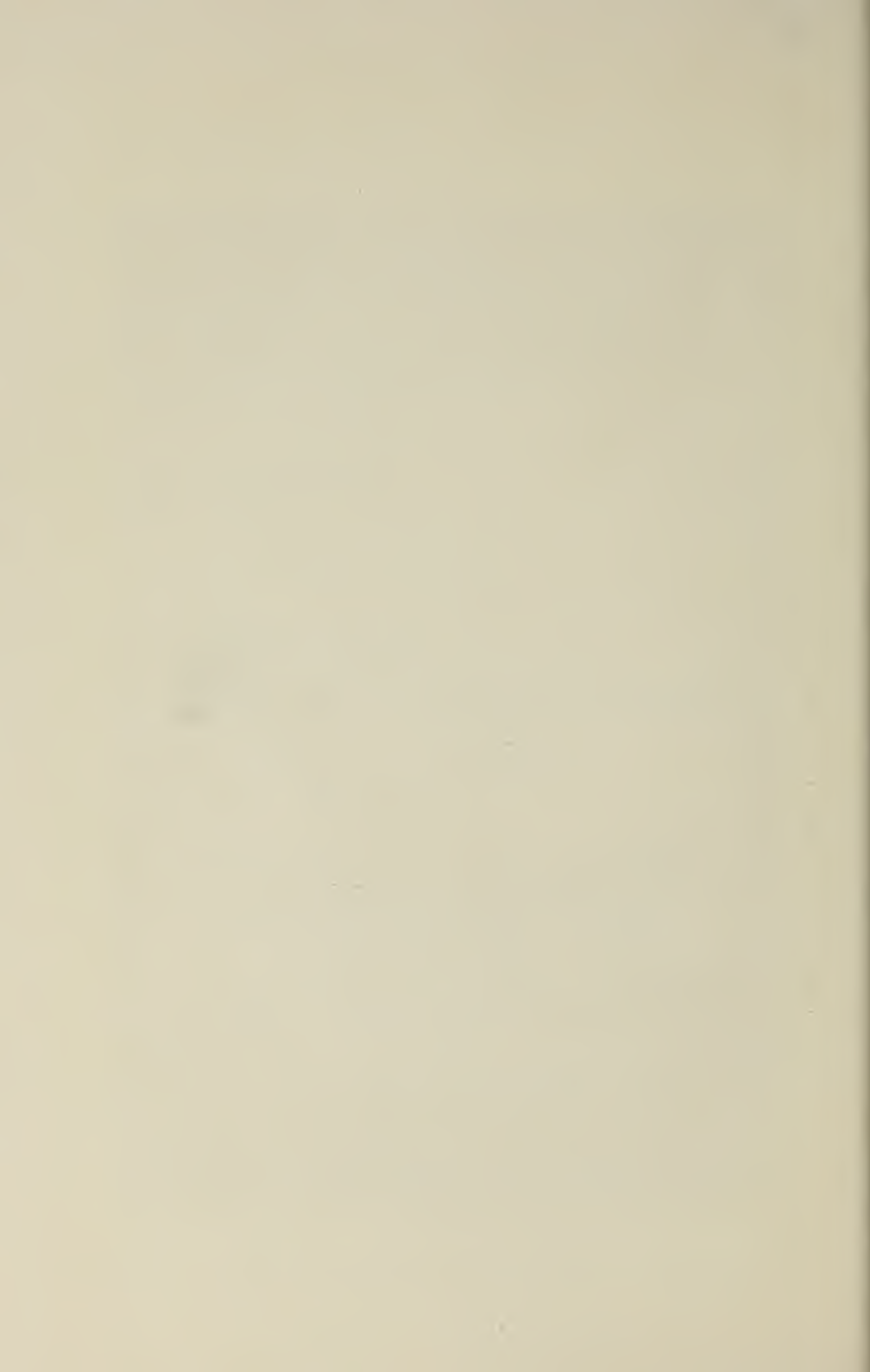
The two branches converge again, and at a distance of 1,000 feet from the entrance enlarge into Music Hall, a large room containing a raised platform of rock, known as the Band Stand. A short distance farther on, a branch goes off to the left which has been explored only by guides, the ceiling being low and the scenery possessing no especial interest.

Fourteen hundred feet from the entrance the main passage again forks the right branch containing Cave Hill Cemetery. Herein are found some beautiful stalagmites and pillars, one of which, called Washington's Monument, is among the most striking objects of the cave. Its height is four feet eleven inches, and a foot above the base it is two feet in circumference. Composed of the clearest of crystalline limestone, it stands with its white surface gleaming in the dim lantern light, inspiring the visitor with a feeling of wonder as to how an object of such beauty and purity could have been formed in these depths of Cimmerian darkness. Another monument of greater size, but less imposing, on account of its yellowish brown color, is the Tower of Babel—ten feet high and six feet eight inches in circumference. It stands among numerous smaller stalagmites, a short distance beyond Washington Monument.

Beyond the Tower of Babel the roof of the right branch lowers, and we crawl through a narrow opening and then creep or stoop for quite a distance through Creeping Avenue, passing meanwhile among many pillars, stalagmites and stalactites, varied in form and beautiful to look upon. We emerge and stand erect 2,000 feet from the entrance, in the Junction Room, where the branch which turned to the left at the entrance to the Cave Hill Cemetery meets the right branch through which we have traveled. Beyond this point the cave narrows and the roof comes down within a foot of the floor. By creeping, crawling and twisting from side to side we manage to get up a slippery hill and through a small opening into



"ADAMS EXPRESS CO." AND "PILLAR OF CONSTITUTION," MARENGO CAVE, CRAWFORD CO., IND.



the Fairy Palace, a place visited by few on account of the difficulty of the way. Here we find the farthest explored part of the cave, and in the small room, perhaps ten feet wide and five feet high, are thousands of formations, which reflect our light in a most brilliant manner. Retracing our way to the Junction Room, we turn to the right into the Prison Cell, a large room which contains some of the principal features of the cave. Here is the Leaning Tower of Pisa, a stalagmite six feet high, with the top inclined several inches beyond the base; Solomon's Temple, a group of slender pillars six and a half feet in height and arranged in a circle; Administration Building, a pillar made up of a series of circular layers of crystalline limestone, piled one on top of another so as to cause the whole to resemble a Japanese pagoda; Bunker Hill Monument, formed on a fallen slab, story on story as the preceding, besides many others as handsome, yet too numerous to mention. We pass from the Prison Cell, between the Prison Bars—a series of slender columns six feet long and six to eight inches in circumference—into Washington Avenue, the left branch of the main passage at the fork near Cave Hill Cemetery. This avenue is 450 feet in length, from twenty-five to forty in width, and for about one third of its length the ceiling is so low as to require a stooping position in passing through. On the way are many small stalagmites grouped in a straggling fashion, Grant's Army and Coxey's Army being the names given to two of the largest assemblages. The floor of Washington Avenue is dry and for the most part composed of earth, with here and there a slab of fallen rock. Near the fork it descends for about fifteen feet, and we enter once more the main passage, already described, and make our way along it to the "Cut Off" leading to Crystal Palace, passing on our left the Lover's Retreat, a winding cleft which extends about seventy-five feet back into the solid limestone.

The Crystal Palace is the crowning glory of Marengo Cave. It is a small alcove or side room, ninety feet long, fifteen feet wide and about twenty-five feet in height. At the south end is a perpendicular wall along which is a drapery or vast sheet of stalactites, and from a projecting shelf are many slender stalagmites, the whole so grouped as to resemble a giant pipe organ. The side walls are studded with hundreds of small and large formations, while from the roof hang perpendent myriads of slender stalactites of the clearest crystal, which reflect with sparkling brilliancy the rays of the calcium or magnesium flash lights. By ascending a stairway fifteen feet, one finds himself on a balcony in the very midst of these formations and can pass back into Crystal Palace Gallery, a low passage, about 150 feet in length, the floor of which resembles a relief map, being thrown up in many places in narrow corrugations and ridges, with here and there a pool of limpid water occupying the irregular and shallow depressions.

Descending the stairway and passing to the left, we enter the Western Avenue or Short Route, the principal feature of which is the Pillared Palace, where giant pillars, stalactites and stalagmites are so numerous that it is with difficulty the visitor winds his way between and around them. This portion of the cave extends but about 150 feet in a westerly direction, and into it has been dug an artificial opening from the surface, forty feet above. Retracing our steps for the last time, we turn to the left at the mouth of the Pillared Palace and pass through another bower of beauty, the Queen's Palace, a small room, whose walls are composed wholly of pillars and stalagmites. Beyond this we pass the Diamond Dome, the largest stalagmite of the cave, thirty-one feet in diameter and reaching from ceiling to floor, and emerge into Grand Entrance Hall, which was our starting-point.

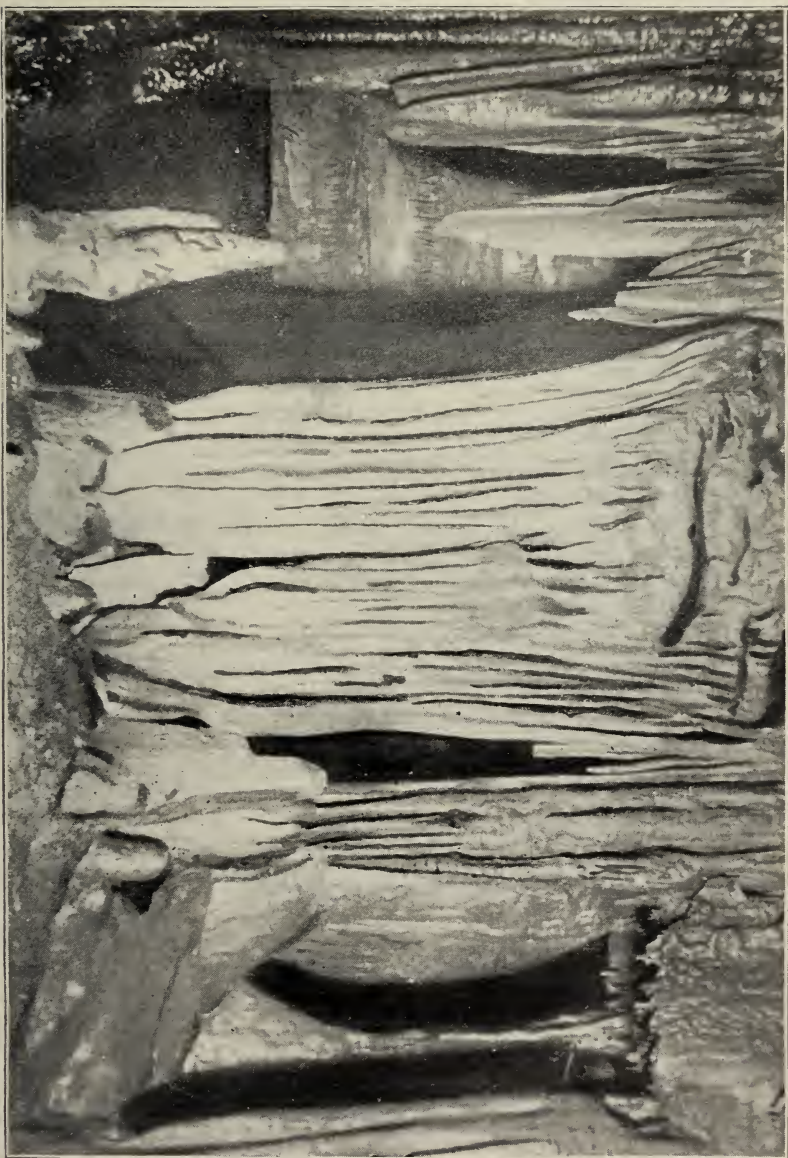
The total length of Marengo Cave, including the side branches through which we passed, was as follows:

Long Route, foot of stairway to Junction Room.....	1,950 feet.
Junction Room to end of Fairy Palace	175 feet.
Junction Room to Prison Bars.....	200 feet.
Washington Avenue	450 feet.
Lover's Retreat.....	75 feet.
Elk's Hall.....	190 feet.
Nameless Pass.....	150 feet.
Cut-off.....	100 feet.
Crystal Palace and Gallery	250 feet.
Short Route to place of starting	310 feet.
Total	3,850 feet.

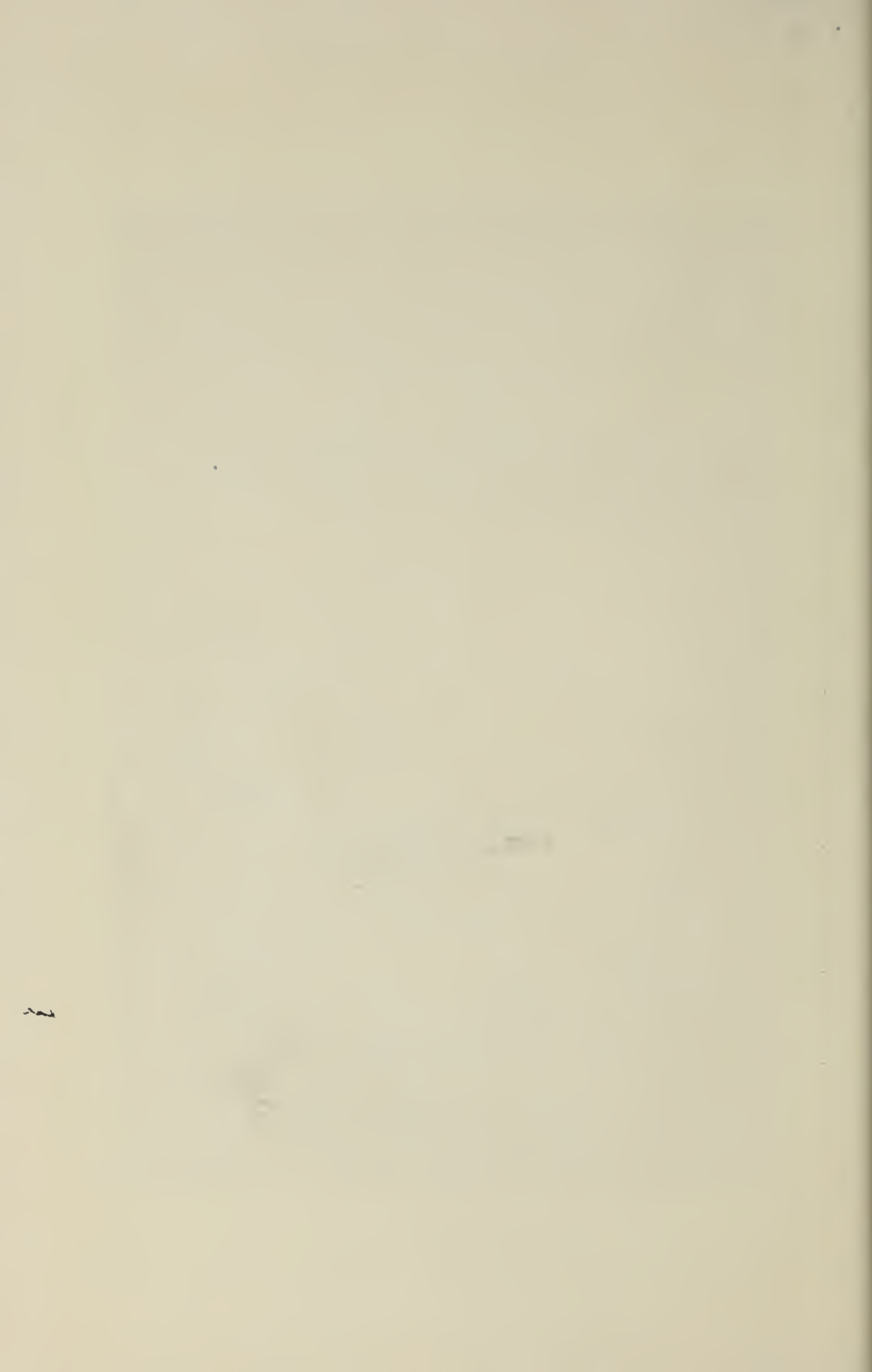
Within this distance of less than three-fourths of a mile are probably crowded more beautiful formations of crystalline limestone than in any other known cave of similar size in the United States.

Lacking the length, the lofty vaulted rooms and the grand scenery of Wyandotte, Marengo far excels that cave in the abundance and beauty of its stalactites, stalagmites and other cave formations. To those who wish but a glimpse of underground life, we most heartily commend it, believing that a visit of a few hours will repay all who take an interest in the mysterious and beautiful in nature.

FAUNA The fauna of Marengo cave is not as varied and as numerous as one would suppose. The short time that has elapsed since the cave was opened and the erection of a building above the entrance have prevented many forms of life from entering and taking up their abode therein. Of vertebrates, a form of the white-footed mouse, *Hesperomys leucopus* Raf., is frequent in the first 250 feet. Several were caught in cyclone traps, and, while possessing larger ears, longer whiskers and more protruding eyes than above-ground specimens, these variations were not definite enough to separate the form even as a distinct variety. The



ENTRANCE TO PILARED PALACE, MARENGO CAVE, CRAWFORD COUNTY, INDIANA.



cave salamander, *Spelerpes maculicauda* (Cope), was taken at the side of the entrance, and is said by the guide to occur thereabouts at all seasons of the year. But one species of crustacean, *Cacidotæa stygia* Packard, was secured. It was very plentiful beneath some pieces of boards in a pool at the side of the "Prison Bars." The blind crayfish is said to occur in some pools near Diamond Dome, but none were to be found at the time of our visit. The myriapod, *Pseudotremia cavernarum* Cope, so common in Wyandotte, is also plentiful in Marengo, and was the only member of the group there taken. Of Coleoptera, but three specimens of one species, *Quedius fulgidus* Fab., were secured. They were found within 250 feet of the entrance beneath a board used to bridge a damp spot. The Thysanuran, *Degeeria cavernarum* Packard, was plentiful and a single specimen of a larger, lead colored species was taken in company with the beetle above mentioned. Two species of Diptera, both new to science and one representing a new genus, were taken. They are described, in a paper accompanying this report, by Prof. J. M. Aldrich, under the name of *Limosina tenebrarum* and *Odontopoda* (n. g.) *sayi*. The former was taken in several other caves, the latter only in Marengo, 400 feet from the entrance. The only additional form of animal life taken was *Nesticus carteri* Em., a small spider, several specimens of which were found crawling over the damp rocks, 300 feet in the main passage. Three species of fungus, one thin, white, and spreading over the under side of boards, another spreading in large, thin, fan-shaped masses over rocks; and the third, a large stemmed toadstool, were taken about 400 feet within the cave.

WYANDOTTE CAVE.

Next to Mammoth Cave, Kentucky, Wyandotte is the largest cavern in the United States. Its enormous underground halls and vaulted domes, its gigantic fluted columns, and vast piles of fallen rock are unexcelled in any other American cavern. Its situation among the rugged hills which form the breaks of the Ohio River, in a country as yet primitive in character, where game is plentiful, and fishing in the clear waters of Blue River exceptionally good, makes it a most inviting spot for a summer's outing.

Around the hotel, situated on a commanding eminence in a natural wooded grove close to the cave, grow many forms of plant life which are strangers to central and northern Indiana, while in the cave dwell many sightless animals whose habits of life are yet unknown, so that the botanist and zoölogist may add to the study of the cavern itself, the pursuit of their favorite studies.

HISTORY. The records concerning Wyandotte Cave go back only to 1812. During the war with England the demand for gunpowder became

so great that much of the nitrous earth in the caves of Indiana and Kentucky was utilized in the manufacture of potassium nitrate, or saltpetre, one of the principal ingredients of gunpowder. What is now called the "Old Cave," was the only portion of Wyandotte then known to the whites, and to it the name of "Indiana Saltpetre Cave" was given by a Dr. Adams who first preëmpted the land on which the cave was located, for the purpose of manufacturing saltpetre. He carried on the business on an extensive scale from 1812 to 1817, and remains of leaching hoppers, troughs, etc., can yet be seen near the mouth of the cave, and at "Saltpetre Cave," about a third of a mile distant. The close of the war made the "petre" business unprofitable, and Dr. Adams relinquished his claim.

In 1819 Mr. H. P. Rothrock, the father of the present proprietor, purchased the land from the Government, paying the prevailing price, one dollar and twenty-five cents per acre. He did not attach any value to the cave, but wished the land for the timber growing upon it, he having erected a sawmill on the banks of Blue River, about a mile from the mouth of the cave.

But little attention was given to the cave by the owner and the residents of the vicinity. In fact the latter considered it a nuisance and in 1843 succeeded in getting the State Legislature to pass a law compelling Mr. Rothrock to fence up the entrance, so as to prevent cattle from entering and licking the epsom salts, which the cave contains in abundance.*

The only published account of Wyandotte cave previous to 1850 which has come to my notice is found in Flint's Geography of the Mississippi Valley, 1833, p. 389, as follows:

"Like Alabama and Tennessee, Indiana abounds with subterranean wonders in the form of caves. Many have been explored, and some of them have been described. One of them is extensively known in the western country by the name of 'the Epsom Salts Cave.'

"It is not very far from Jeffersonville. When first discovered the salts were represented as being some inches deep on the floor. The interior of this cave possesses the usual domes and chambers of extensive caverns, through which the visitant gropes a distance of a mile and a quarter to the 'pillar,' which is a splendid column, fifteen feet in diameter and twenty-five feet high, regularly reeded from top to bottom. Near it are smaller pillars of the same appearance.

"The salt in question is sometimes found in lumps varying from one to ten pounds. The floors and walls are covered with it in the form of a frost, which, when removed, is speedily reproduced. The earth yields from four to twenty pounds to the bushel, and the product is said to be

* Revised Statutes 1843, Chap. 53., p. 974, sec. 67.



THE ENTRANCE TO WYANDOTTE CAVE. I

of the best quality. Nitre is also found in the cave in great abundance, and sulphate of lime or plaster of paris."

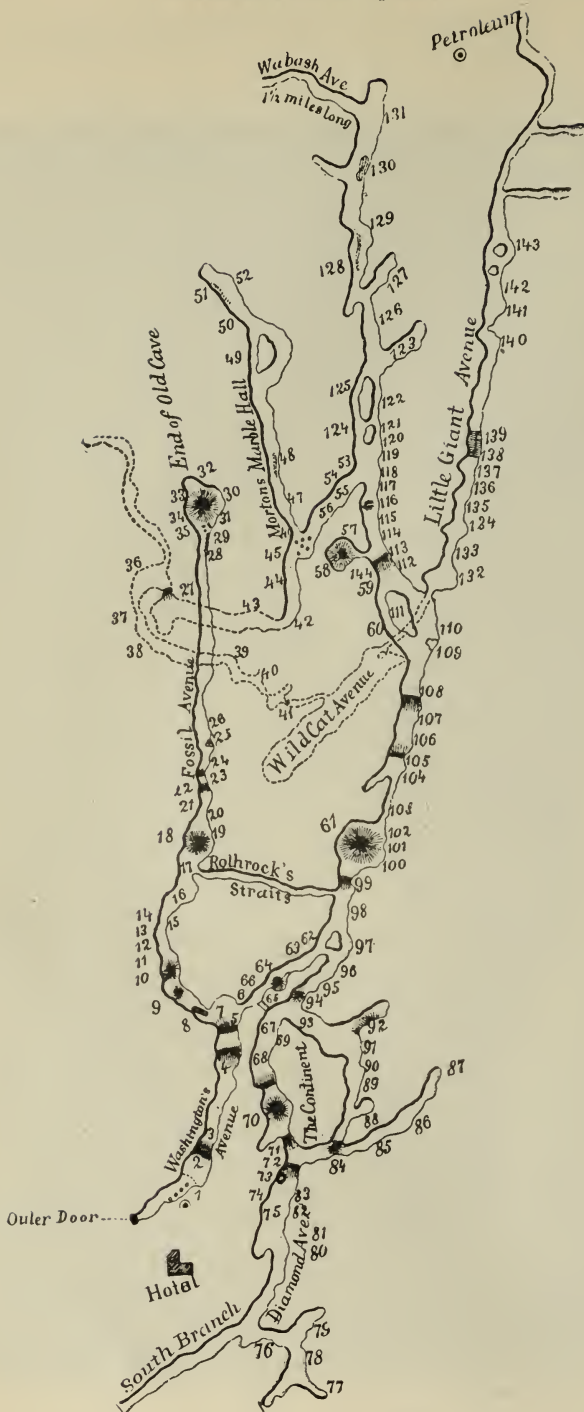
In 1850 a party from Fredonia, Ind., observing that a current of air was passing from beneath a large, loosely placed flat rock, 1,000 feet from the mouth and at the point at which the route of the "Old Cave" turns abruptly to the left, succeeded in prying the rock loose and found the opening since known as Fat Man's Misery. This they entered and passed through, and for the first time white men stood in the "New Cave." The "Long Route" was soon explored as far as the Sulphur Spring in Rothrock's Cathedral, and the "Short Route" to its present known limits. About a year afterward a small opening through a stalagmitic formation by the side of the Sulphur Spring was observed, and by active use of hammers and drills was enlarged sufficiently for persons to enter. The opening was called the "Augur Hole," and through it explorers passed and made their way as far as the ends of Wabash Avenue and the Fairy Palace. In 1858 W. R. and J. G. McCollister enlarged the opening leading from the "Easter Room" and partially explored the passage now known as the "Unexplored Route." The next year Mr. G. J. Langsdale and Washington Rothrock finished the exploration of this passage as far as Rothrock's Island. This includes all the explored portions of the cave, with the exception of Milroy's Temple, which was discovered by a party of students from Wabash College in 1878. A number of descriptions of the cave have appeared in various papers, magazines and reports; a list of those which have come under the writer's notice being found in the bibliography at the end of the present paper.

The mouth of Wyandotte cave is located in the southwest quarter of section 27 (township 3 south, range 2 east), Jennings Township, Crawford County, Indiana. The nearest railway, the "Air Line," passes through Milltown, nine miles distant from the cave, over an exceedingly rough road. From Corydon, the county seat of Harrison County, the distance is about twelve miles, and the road a fair one for southern Indiana. This route is a most pleasant drive in the summer or autumn, and leads one down the romantic valley of Blue River. For several miles the road follows along the limestone bluff on the right side of that stream, in many places having been excavated in the side of the bluff forty or more feet from the water below. From Leavenworth, on the Ohio River, the nearest point for steamers, the distance is five miles.

The Cave Hotel is, according to measurements made by Professor Collett, 220 feet above Blue River, across whose narrow valley "Greenbrier Mountain, with sharp, conical peak and steep faces, belted with massive rings of rock, variegated with evergreen cedars, affords a scene of quiet, stately beauty."* From the hotel a pathway leads down a gradual slope to the mouth of the cave 100 yards away.

*Collett, Geol. Surv. Ind., 1878, 467.

WYANDOTTE CAVE.



- 0 Saltpetre Hoppers.
- 1 Arched Entrance.
- 2 Faneuil Hall.
- 3 Columbian Arch.
- 4 Falling Rock.
- 5 Wyandotte Chief.
- 6 Entrance to New Cave and Fat Man's Misery.
- 7 Banditti Hall.
- 8 Jacob's Ladder.
- 9 Pigmy Dome.
- 10 Debris Dome.
- 11 Continued Arch.
- 12 The Canopy.
- 13 Lucifer's Gorge.
- 14 Natural Bridge.
- 15 The Stoop.
- 16 Temple of Honor.
- 17 Secret Entrance to Rothrock's Straits.
- 18 Odd Fellows' Hall.
- 19 Phantom Ship, "Millie."
- 20 Pharaoh's Stairway.
- 21 Conrad's Hall.
- 22 The Cliffs.
- 23 The Pit.
- 24 Falls of Minnehaha.
- 25 Dead Fall.
- 26 Cyclops' Chasm.
- 27 Dead Sea.
- 28 Screw Hole.
- 29 Polished Boulders - Indian.
- 30 Senate Chamber.
- 31 Chair of State.
- 32 Pluto Ravine.
- 33 Stallas's Monument.
- 34 Stillo Mountain.
- 35 Pillar of the Constitution.
- 36 Heman's Bower.
- 37 Hine Cliffs.
- 38 Lonizan's Pass.
- 39 Diamond Labyrinth.
- 40 Emmoncey Arcade.
- 41 Rode Rock No. 1.
- 42 Queen Mab's Retreat.
- 43 Snow Banks.
- 44 Zoe Grotto.
- 45 Ice House.
- 46 Frosted Rock.
- 47 Snowy Cliffs.
- 48 Indian Footprints.
- 49 Beauty's Bower.
- 50 Queen Mab's Marble Garden.
- 51 Fairy Palace.
- 52 Wyandotte Potatoes - Pebbles.
- 53 The Arm Chair.

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| 54 Lovers' Retreat. | 86 Neptune Retreat. | 115 Vestry. |
| 55 Ewing Hall. | 87 Hermit Cell. | 116 Josephine's Arcade. |
| 56 Frost King's Palace. | 88 The Sepulchre. | 117 The Parsonage. |
| 57 Bowlder Flints. | 89 Purgatory. | 118 The Junction. |
| 58 Milroy's Temple. | 90 Caliope Bower. | 119 The Lone Chamber or Ball Room. |
| 59 Penelope Grotto. | 91 Palace of the Genii. | 120 Dry Branch. |
| 60 Ulysses' Straits. | 92 Pillared Palace. | 121 Island of Confusion, or No. 3. |
| 61 Rothrock Cathedral. | 93 Creeping Avenue. | 122 Grand View Island, or No. 4. |
| 62 Coons' Council Chamber. | 94 Junction Room. | 123 Sandy Branch and Air Torrent. |
| 63 The Rotunda. | 95 Drawing Room. | 124 Newhall's Forum. |
| 64 Rugged Mountain. | 96 Dining Room. | 125 Grosvenor's Avenue. |
| 65 Cut Off. | 97 Delta Island. | 126 Gothic Chapel. |
| 66 Counterfeiters' Trench. | 98 Sandy Plain, 300 feet long. | 127 The Gallery. |
| 67 Starry Hall. | 99 Hill of Difficulty. | 128 Indian Footprints. |
| 68 Wyandotte Grand Council Chamber. | 100 Monument Mountain, 135 feet high, over which is Wallace's Grand Dome, 50 feet above top of Mountain, and 185 feet above base of the hill. | 129 The Den. |
| 69 The Card Table. | 101 Sulphur Spring. | 130 Ship in the Stocks. |
| 70 Hall of Representatives. | 102 The Augur Hole. | 131 Crawfish Spring. |
| 71 Hill of Science. | 103 Lilliputian Hall. | 132 Maggie's Grotto. |
| 72 The Alligator. | 104 Spade's Grotto. | 133 Joseph's Pit. |
| 73 The Mound. | 105 Slippery Hill. | 134 Lama's Bower. |
| 74 The Throne. | 106 Hall of Ruins. | 135 Marble Rivulet. |
| 75 General Scott's Reception Room. | 107 White Cloud Room. | 136 Marble Hall. |
| 76 Anteroom. | 108 Sentinel Office. | 137 Miller's Reach. |
| 77 Hovey Point. | 109 Bishop's Rostrum or Pul-pit. | 138 Andrew's Retreat. |
| 78 The Pit and Sieve. | 110 Journal Office. | 139 Rode Rock No. 2. |
| 79 The Amphitheater. | 111 Calypso's, or Island No. 2. | 140 The Devil's Elbow. |
| 80 Rocky Hill. | 112 Cerulean Vault. | 141 The Pit. |
| 81 Muddy Fork. | 113 Rugged Pass. | 142 Langsdale's Basin. |
| 82 Lost Rivulet. | 114 Chapel. | 143 Wash. Rothrock's Island. |
| 83 Frozen Cascades or Curtains. | | 144 Bourbonoi. |
| 84 The Hippopotamus. | | |
| 85 Fairy Grotto. | | |

THE OLD CAVE. We shall first describe that portion of the cave known previous to 1850, and at present called by the guides the "Old Cave." The mouth of the cave is twenty feet wide and six feet high; the roof arched, the floor of earth, with here and there a fallen slab of rock. For perhaps 100 feet* we descend gradually and enter a spacious corridor known as Faneuil Hall, forty feet wide, eighteen feet high, and probably 180 feet in length. Across the farther end of this hall a stone wall has been built, and a doorway constructed, and through this one passes into Twilight Hall, where the last rays of daylight disappear and the King of Darkness begins his reign. Stopping a few moments to accustom our eyesight to the changed conditions, we pass onward and soon enter the "Columbian Arch," an almost perfect semi-cylindrical tunnel, seventy-five feet in length. From this we emerge into "Washington Avenue," a grand passageway, 275 feet long, thirty feet wide and forty

*The proprietor of the cave, Mr. H. A. Rothrock, would not permit accurate measurements to be made, except of a few of the rooms. It is needless to say that the measurements as given in the previous geological reports have many of them been greatly exaggerated. The map of the cave accompanying this report is the same as was published in the report for 1878, it being impossible to make a new map without new measurements to verify the distances.

feet high. Near the farther end is 'Falling Rock,' a huge mass of limestone, resting partly on edge, $33 \times 16 \times 14\frac{1}{2}$ feet in dimensions, and weighing, therefore, about 535 tons. Ages ago it fell from the roof and assumed its present position, one which earthquakes have failed to change, but which appears dangerous to the average visitor who passes beneath its towering form.

Within Washington Avenue a peculiar pungent odor became noticeable, and inquiry as to its source brought information from the guide that in 1884 certain gentlemen of Evansville attempted to corner the onion industry of southern Indiana by buying up all the onion sets produced that season. Wishing a suitable storehouse, they rented room in the cave and deposited therein several hundred barrels of the sets. But, however suitable the pure cave air is for the preservation of sweet potatoes and other mild edibles, it failed to act in like manner on the onions, and they soon began to sprout and grow. All were lost and were allowed to remain in the cave, their shriveled skins and pungent odor still reminding the visitor thereto of an attempted financial "corner," which failed to materialize. Another odor, more strong and disagreeable, especially in autumn and winter, is noted at this point or before. It is that of the exhalations of thousands of bats, which make the cave a winter-abiding place. Their faint squealing notes and flutter of wings are the only sounds that greet us from the depths of darkness beyond.

Passing under the "Falling Rock" and up a short declivity, we find ourselves in Banditti Hall, fifty feet wide, forty to fifty high, and partially filled with rugged fallen rock, grouped in great masses on either side of the pathway. Stepping from slab to slab, we pick our way, until finally the guide calls a halt and, lighting some "red fire," directs our attention to two outline figures formed on the ceiling above, by the scaling of the dark exterior from the whiter limestone. To one the name "Wyandotte Chief" was given many years ago by a correspondent of the *Cincinnati Times*, who wrote of it as follows: "We look up and see above the Falling Rock a mass of white limestone resembling the front of an Indian chief, with crown shorn to the scalp lock and fanciful ear-rings dangling from the ears. There he hangs, seemingly suspended, like Mahomet's coffin, keeping his dark and weary vigils, waiting to gloat over the death of some daring paleface, crushed by the Falling Rock below." Upon the other figure, which resembles the facial characters sometimes seen in Punch and Judy shows, the fanciful name of "Betsy and I Are Out" has been bestowed.

Banditti Hall is the closing portion of the common entry to both the Old and New caves. At its farther end the opening leading to the Old Cave is seen on the left, some twenty feet above the level of the floor, while about the same distance below, on our right, opens the doorway into "Fat Man's Misery" and the New Cave beyond.

Climbing a steep ascent into the Old Cave, we find ourselves at first in a passageway ten feet wide and seven feet high, with the floor of ochery clay a number of feet thick, the walls of oölitic limestone, and the roof here and there with the more soluble portions dissolved until it resembles a coarse-celled honeycomb in appearance. Passing onward beneath "Pigmy Dome," we enter "Continued Arch," a long passageway eight feet in height, ten feet wide, with an occasional crystal of selenite glistening on the dry and dusty floor. From this we pass into the "Canopy," a circular room, twenty feet in diameter and ten feet high, with a smooth white roof. This is succeeded by another long, low passage, where stooping is necessary for some distance, and then we pass down through a narrow passage into Lucifer's Gorge, forty feet deep, with precipitous, jagged rocks overhanging the sides. Up we climb once more, from rock to rock, and, reaching another opening, crawl over a natural bridge, and on hands and knees creep for seventy-five feet through the "Grecian Bend." Finally we emerge into Odd Fellows' Hall, one of the grand underground rooms for which Wyandotte is noted. This we measured carefully and found to be ninety feet wide, 210 feet long and sixty-five feet or more in height. The massive ledges of limestone forming the walls project toward the top, each layer a few inches farther than the one below, so that the ceiling is oval in shape, much narrower than the floor and appears to be hollowed out by successive fallings of rock. Great masses of fallen rock partially fill the room, and bats by tens of thousands hang head downward from the ceiling. We extinguished the lights, and their low squealing notes became instantly hushed, and the only sound which broke the death-like stillness was a continuous faint and lisping noise, like the ripple of water over a distant waterfall, due probably to the rustle of the wings of such as were flying through the Plutonian darkness.

On the right side and about fifty feet from the entrance to Odd Fellows' Hall is a pit hole or perpendicular cleft in the floor, through which an average sized man can just squeeze himself. This is the opening into Rothrock's Straits, a deep and narrow passageway which connects with the new cave in Rothrock's Cathedral.

From Odd Fellows' hall we climb by a rugged stairway and pass onward through narrow passages, and beside pits and chasms—the way ever seeming to grow rougher—the hills and valleys following each other in rapid succession. In one place we descend full fifty feet and from the bottom note on our right the perpendicular walls of rock known as the "Cliffs." Over these in ages past a drapery of stalactites has been thrown in graceful folds, resembling a cascade which in mid-air has been congealed into stone, and is most worthy of its name—"The Falls of Minnehaha." Below these overhanging cliffs is the gaping mouth of the "Pit"—a deep cavity leading by one drop fifty feet into space—as yet

unexplored. From the foot of the "Cliffs" we make our way with difficulty up Uncle Sam's Stairway and then under the "Dead Fall," a large, flat rock which lies at an incline across the passage, the upper edge supported by less than three inches of a thin rock projecting from the wall. From the "Dead Fall" onward for a distance of perhaps 1,000 feet the way is a succession of steep climbs and steeper descents, varied by an occasional crawl on hands and knees; and a final twisting of the body into shapes innumerable in order to effect the passage of the "Screw Hole," which forms the portal to the "Senate Chamber," the final room of the Old Cave.

Collett describes* the Senate Chamber "as a vast elliptical amphitheater, estimated at six hundred feet long and one hundred and fifty feet wide. The sides are built up with massive ledges of limestone, thinning and converging upward into a monster dome, with a flat elliptical crown fifty by twenty feet in diameter. The center of this vast room is piled up with a great mass of rocky debris fallen from the immense cavity above."

Other than the dimensions, the above is an excellent description of the room. Exact measurements show the room to be 144 feet long and 56 feet in width. The mass of fallen rock in the center, known as "Capitol Hill," is about thirty-two feet in height and is crowned to a depth of several feet with an immense mass of stalagmitic material. From the center of this mass rises from the top of the hill the grandest natural wonder in Wyandotte Cave—the great fluted column of satin spar, or crystalline carbonate of lime, known as the "Pillar of the Constitution." Perfectly cylindrical, seventy-one feet in circumference, and extending from the crest of the hill to the ceiling above, this enormous column exceeds in magnitude any similar formation in any known cave on earth. From the point where it first became visible in the dim light of our candles it appeared "like an immense spectral-looking iceberg looming up before us, looking as if it had just arisen from the foaming waves of the ocean on a dark and foggy night." The entire column is composed of "satin spar"—a rather soft, white, striated mineral, the purest form of carbonate of lime. From one side, near the base of the column, has been removed by the Indians or some prehistoric race in ages past, several hundred cubic feet of this material. A full account of some interesting discoveries made here will be given farther on under the heading of "Former Visitors to Wyandotte Cave."

Down the sides of the "Pillar," tiny streams of water are constantly trickling, and, spreading out upon the top of the hill, quickly evaporate, leaving behind the solid particles to make thicker the crust of so-called "alabaster," which covers the rough edges of the mass of rocks. This

*Indiana Geol. Surv., 1878, 473.

will continue for thousands of years, until ultimately, by continued accretions, this hill will reach the ceiling and enclose entirely the wondrous pillar with its flutings and carvings, wrought in ages past by that magic graver—water.

Back of the "Pillar of the Constitution" is the "Chair of State"—another handsome mass of stalactites and stalagmites that extends from the top of the hill to the ceiling. Behind this on the right is the entrance to "Pluto's Ravine," the roof of which is studded with representations of sprigs, twining tendrils and branching corals, all wrought from calcite and "alabaster" in most exquisite fashion by the hand of nature. Many are broken, being the remains of those removed before 1850, when the cave and its contents were esteemed but lightly by the owner, and no care was taken to prevent its despoliation by visiting vandals. Beyond this point one can penetrate but a few yards in the "Old Cave," the roof and floor coming close together and barring farther progress.

Much diversity of opinion prevails as to the distance between the "Pillar of the Constitution" and the mouth of the cave. Stelle, in his work published in 1864, says it is "just three miles." Both Collett and Hovey place it at two miles. Flint, in 1833, before it was thought necessary to exaggerate the distance, gives it as one and a quarter miles. Pedometer measurements, made by Mr. Peddle, make it one and one-sixth miles, so that Flint's statement is probably not far out of the way. The rough character of the passage, the many steep ascents and corresponding declivities, added to the oppressive silence, cause persons unaccustomed to subterranean travels to think the distance much greater than it really is.*

SHORT ROUTE. As before noted, one must pass from the mouth of the cave to the end of Banditti Hall and there start on the Short Route through a narrow and slippery descending passage known as the "Scuttle" or "Fat Man's Misery." By sliding or crawling downward for about 15 feet, we find ourselves at the entrance of "Bat's Lodge," a low room 70 feet long, 21 feet wide and five to six feet high, the walls and roof begrimed with the smoke of fires kindled by former inhabitants, of which more anon; the floor a mixture of dry, dusty earth, with here and there a piece of fallen limestone. We have been gradually descending from the mouth of the cave to Bat's Lodge, and barometer measurements show the floor to be 150 feet lower than the Cave Hotel. Beyond this room the roof so closely approaches the floor that "Counterfeiter's Trench" was dug through the earthy deposit which had silted up the

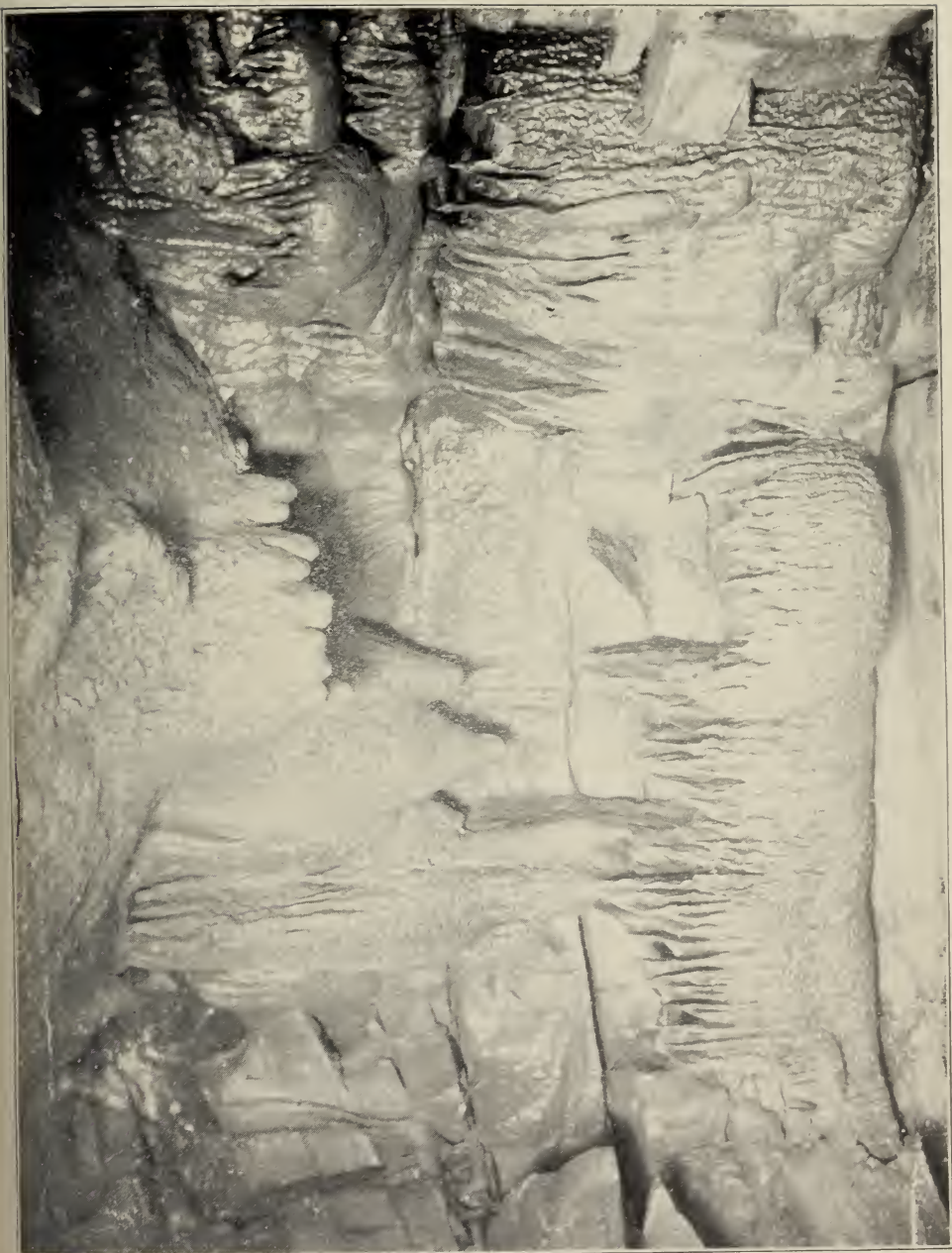
*The lengths of all the caves visited by our party were found to be much less than they were reported. Where the natives had explored for "miles underground," guessing the distance as they went, careful measurements proved their miles to be rods, or, at the best, furlongs. For example, Marengo Cave has been advertised far and near as containing seven miles of underground passages. Our measurements showed its total length to be 3,850 feet, or seven-tenths of one mile. Except the lengths of the passages in Wyandotte, Mr. Peddle made all measurements with a 50-foot tape, hence they can be relied upon as being exact.

way. Through this trench we easily pass and find ourselves at the foot of "Rugged Mountain," a mass of broken pieces of limestone, thirty feet or more high, which fills the greater part of a large room. Climbing this mountain we reach the "Rotunda" or upper portion of the room, 52 feet one way by 90 feet the other, with the roof 16 feet above the top of the mass of rock. Around the edges of the room are numerous deposits of fine, white, needle-shaped crystals of epsom salts (magnesium sulphate) encrusting the rocks and sparkling like frostwork in the light of our candles. They seem to exude from a porous matrix of magnesian limestone, and if not disturbed often attain a length of three to five inches. Passing down "Rugged Mountain" on the farther side we enter "Hanover Chapel," where numerous artificial piles of heavy stones, dedicated to some Greek fraternity or college class, stand as monuments to the muscular ability of visiting students in days gone by.

A short distance beyond this point we climb again and enter the "Coon's Council Chamber," a circular room 35 feet in diameter. Here two bands of blackish flint or jasper about four inches in thickness, first noted in descending Fat Man's Misery, are very prominent around the walls. A few yards farther on we come to "Delta Island," an uneroded mass of limestone, 50 feet long by 20 feet wide, on either side of which one may enter that part of the cave called the "South Branch," which forms the greater portion of the Short Route. To the left of Delta Island the passageway leads onward through "Rothrock's Cathedral" and the "Augur Hole" to the end of the "Long Route," described under another section.

Passing to the right we enter the "Dining Room," 40 feet wide, 10 feet high and 70 feet in length, the monotony of the limestone walls being relieved by several bands of jet black flint, about three feet apart. One of these bands has the flint in quadrangular blocks, while in the others it is in nodules, many of which are several inches in diameter. Sometimes these nodules resemble in form a geode, and when broken show a crystalline center, the siliceous particles having collected and crystallized about a common nucleus. Leaving the Dining Room we proceed through a short pass to the "Drawing Room," whose dimensions are about 25 x 10 x 60 feet, and from this into the "Junction Room." From here three passages diverge, one to the left through Creeping Avenue, one straight ahead to the right of the "Continent," the latter being a vast mass of uneroded limestone, around which the two branches of the old subterranean river formerly flowed, and the third, known as the "Cut Off," turning abruptly to the right and entering a short, tortuous, descending passage, which leads out into the main cave between Counterfeiters' Trench and Rugged Mountain.

Taking the passage past the right of the "Continent" we enter the "Council Chamber," a spacious room 15 x 50 x 100 feet, which, like



THRONE AND CANOPY, WYANDOTTÉ CAVE.

"Hanover Hall," contains many artificial monuments, erected in the past by enthusiastic visitors who knew no better way of proclaiming to the world the fact of their existence. Narrowing again, the main passage continues for perhaps 200 feet, when once more it expands into another of those grand subterranean rooms which characterize Wyandotte Cave. This has been dubbed the "Hall of Representatives," accurate measurements showing it to be 100 x 60 feet, with the ceiling 35 feet above those masses of fallen rock which in the past filled the space of the broad dome above. Where these large rooms occur, the old river which eroded the cave must have flowed over a softer portion of rock and eroded or dissolved a great basin in the bed or floor of the channel, perhaps escaping by an outlet now hidden. In time the roof, no longer self-supporting, came tumbling down and partially filled the basin. From most of the rooms, as from the Hall of Representatives, one must climb 20 or more feet to the mouth of the passage leading onward.

Beyond this hall we descend the "Hill of Science" into a lower portion of the cave, from which a low, wet side passage turns to the right. Here for the first time we encounter mud, and the floor of the "No. 10" passage, as it is called, is for the greater portion of the year covered to a depth of several inches with standing water. We next arrive at the junction room, called "Jordan's Wait," where that noted scientist, Dr. D. S. Jordan, once had several hours for cool reflection, having been left in total darkness by the accidental extinguishing of a candle which he had no means of relighting. This junction room is located at the foot of the "Continent," where the passage which turned to the left around that body, meets the one through which we have traveled.

Turning to the left, we enter the most southern arm of the cave, and, passing through a damp-floored passage, 150 feet long by thirty feet wide, we find ourselves at the foot of a slippery hill on top of which is one of the most handsome formations in the cave—the "Throne and Canopy." The former is composed of a circle of rounded stalagmites cemented together and having the general appearance of a throne of state, while at a distance of six feet above is a curtain of broad, leaf-like stalactites draped in a graceful semi-circle and attached to a projecting mass of crystalline limestone. From a crevice or seam between the massive layers forming the walls the water for ages has seeped, then evaporating, has produced these charming natural wonders, and giving a slippery coat of stalagmite to the surface of the hill below.

Beyond the throne is a long stretch of partly explored avenues and side branches, through which visitors are not often taken, there being therein but one scene of more than passing interest. This is "Helen's Dome," so named by that nestor of cave explorers, the Rev. H. C. Hovey, in honor of his wife. To reach it one must pass through "General Scott's Reception Room," seventy-five by 100 feet in dimensions, and then

by stooping and crawling through a narrow passage into "Diamond Avenue," "where nature asserts her power to work miracles of beauty from cheap materials, transforming gypsum and epsom salts into lustrous crystals which sparkle on the walls and glisten from the floor." Leaving a branch to the right, we turn to the left, and passing cautiously beneath a poised mass of fallen rock, which seemed ready to fall at the slightest touch, we entered a large opening midway between roof and floor, and a few feet farther on found ourselves at the foot of a great circular pit some twenty feet in diameter and extending upward through the solid limestone for eighty feet or more.

This was Helen's Dome, and when the guide kindled his "red fire," and the light therefrom revealed the rugged, waterworn carvings of the sides, and the pendent stalactites which far above gleamed and glistened from their inaccessible heights, we with one accord voted it the wildest and most romantic bit of scenery which the cave possessed.

Retracing our steps to "Jordan's Wait," we take the right branch around the Continent. This leads us on through a low passage known as "Purgatory," 140 feet in length, its floor of yellow ochre, with here and there a handsome crystal of selenite, its roof of white limestone, with many fantastic grooves and carvings wrought in days of yore by the slow but powerful energy of flowing water.

Emerging from Purgatory we assume once more a standing posture, and find ourselves in "Caliope Bower," where many stalactites grace the walls and ceiling. From thence we pass into "Whispering Gallery," where the floor resounds to our tread and the low tones of our voices are echoed back and forth from the arched sides in a manner similar to that noted at the bottom of a deep and empty cistern. Then comes the "Palace of the Genii," where these gods of fable dwell beneath a roof spangled with glittering crystals of calcite and gypsum. The "Pillared Palace" follows, and therein is found a wealth and profusion of cave formations such as no words of man can properly picture. Pillars, stalagmites and stalactites abound of every conceivable form which the fancy can suggest. Many of the stalactites are no larger in diameter than a lead pencil and are curved and twisted in a unique and grotesque manner seen elsewhere in no Indiana cave. Prof. Collett says* that they "are pushed out of the solid rock and still growing by propulsion from the bottom," a statement which the average scientist of to-day will accept *cum grano salis*. The bent and twisted condition of the slender stalactites is doubtless due to the varying currents of air which pass through portions of the cave and force the tiny drops of water on the end of the stalactite first to one side and then to the other of the tip. The air of Wyandotte flows outward, or toward the mouth, in summer, and inward,

*Geol. Surv. Ind., 1878, 476.

or toward the depths of the cave, in winter. This difference in direction of flow can but have its influence on the formation of such slender stalactites as those above mentioned.

Emerging from the Pillared Palace by an ample doorway flanked by handsome pillars of calcite, we leave on our left a room where much quarrying of jasper was done by the ancient visitors to the cave, and pass onward to "Creeping Avenue," where the roof for a distance of 172 feet comes down to within two and one-half feet of the floor, and progress is possible only upon hands and knees. According to the guide, the dryness of this portion of the cave is slowly increasing and as a consequence epsom salts (magnesium sulphate) is becoming more abundant. Where the cave is damp with dripping water, stalactites and other forms of calcium carbonate are abundant; where the dripping has ceased but the walls still give off more or less dampness, calcium sulphate or gypsum is the prevailing formation, and where perfectly dry the epsom salts alone are being produced. The tiresome crawl through Creeping Avenue finished, we stand erect once more in the "Junction Room" at the head of the "Continent" and the exploration of the Short Route is at an end.

The estimated length of the portions passed through, based upon pedometer measurements, is as follows:

Fat Man's Misery to Delta Island.....	1,200 feet.
Delta Island via Creeping Avenue to Hovey's Point.....	2,400 feet.
Jordan's Wait via House of Representatives to end of "Cut Off".....	2,000 feet.
Total.....	5,600 feet.
	1.06 miles.

LONG ROUTE. In going through what is known as the "Long Route" in Wyandotte, we passed from the mouth of the cave to Delta Island over the same way as described above under the "Short Route." At Delta Island we turned to the left and traversed the "Sandy Plain," a passage about 350 feet long, twenty-five feet wide and six to ten feet high; the floor of which is covered in places to a depth of several feet with sand deposited by the ancient cave river. At the end of the "Plain" we found ourselves at the foot of the "Hill of Difficulty," which is but a mass of fallen rock, forming, as it were, a foot-hill to the grander "Monument Mountain," which lies beyond. On the left, in climbing this hill, the guide pointed out the entrance into Rothrock's Straits, that narrow and deeper passage connecting the "Old" and "New" caves.

Reaching the top of the Hill of Difficulty, we found ourselves within the confines of the largest underground room yet known to man—"Rothrock's Grand Cathedral." Before us in the dim candle light was a towering mass of fallen rock, thrown together in most glorious confusion and piercing the gloom above us for 135 feet. Following the guide and clambering from rock to rock, we made the ascent by easy zigzags and

reached a point near the summit with but little fatigue. The crest of "Monument Mountain," like that of "Capitol Hill," in the "Senate Chamber" of the Old Cave, is covered to a depth of several feet with an encrustation of stalagmitic material. This is slowly increasing in thickness by the accretion of solid particles of limestone left by the evaporation of the water which is constantly trickling in a small stream from the roof above. The uppermost ten or twelve feet of the mountain is very smooth and slippery, and one has much difficulty to keep his footing while climbing to the very pinnacle, from which projects a brownish-yellow stalagmite 6.5 feet in height and 3.7 feet in circumference. Below this a short distance, and on the opposite side of the "Mountain" from the entrance, is another stalagmite 6.8 feet in height by 5.2 feet in circumference, while but a short distance away is a third and shorter one. The last two are composed of spotless white, almost translucent limestone, and are known as "Lot's Wife and Daughter."

Forty or more feet above the crest of the mountain expands "Wallace's Grand Dome." The center piece of this is, in the words of Hovey, "a smooth, elliptical slab of oölitic marble 60 feet long by 30 wide, finely contrasting with the darker limestone, from which it is divided by a deep rim, fringed with long stalactites, curling like leaves of the acanthus."

Leaving three candles burning a few feet below the summit, we descended the opposite side, and, extinguishing our lights, as soon as the eye accustomed itself to the surroundings, beheld a scene as grand as human mind can fancy—"an indescribable vision, as if an opening had been made into the realms of supernal splendor." The scene is known as the "Cathedral by Moonlight," the faint candle light reflected from the white, oval dome appearing like a halo of moonlight over the dark crest of the mountain, while the three stalagmites stood like spectral visions surmounting the dark and rugged ledges which rose between us and the source of the faint light above.

Relighting our candles, we found a few feet farther on, the "Sulphur Spring," the trickling waters being caught in a shallow cavity of a round stalagmite. By the side of the spring is a smooth and slippery opening thirty inches wide by fifteen inches high. This is the famous "Augur Hole," which, when first discovered in 1850, and enlarged as before mentioned, admitted the explorers to a large area of unknown passages and rooms—yet none so grand as those already noted.

Through the Augur Hole we made our way, some head first, others the reverse, all finally landing safely about ten feet below in a low, damp room known as "Lilliputian Hall," along which, by stooping, we found our way into "Spades Grotto," once evidently connected with Rothrock's Cathedral by a passage now hidden by fallen rock. From thence, in divers manners, we descended Slippery Hill and found ourselves in the "Hall of Ruins," a passage 150 x 30 feet, with an average height of



ROTHROCK'S GRAND CATHEDRAL, AND MONUMENT MOUNTAIN, WYANDOTTE CAVE.

(The circular space above is the center of the roof of the Cathedral.)

perhaps eighteen feet; then into "White Cloud Room," probably 350 feet in length, where the roof and walls are crusted with an efflorescence of gypsum, resembling after a fashion "billows of fleecy clouds." Beyond this room we passed through the "Journal Office," near the farther end of which is the Bishop's Rostrum, a high platform of rock, 8 x 10 feet in dimensions, from which portions of many a sophomoric oration, as well as several divine dissertations, have in the past been delivered. "Calypso's Island" is a large mass of uneroded limestone, on both sides of which the old cave stream has forced a passage. The floor of the passage to the left of the "Island" resounded our steps in a peculiar echoing fashion, suggesting the presence of a lower passage beneath our feet. The two wings of the main passage converge at the farther end of Calypso's Island and expand into the "Cerulean Vault," a room 40 feet wide by 20 feet high. This narrows into "Rugged Pass," from the side of which a narrow cleft in the rock leads by an ascending, very low and tortuous passage, known as "Worm Alley," into Milroy's Temple. This is a room 100 x 150 feet in dimensions, around the upper edge of which are found some of the most handsome formations in the cave. "One of them is a row of musical stalactites, broad and thin, on which a melody can be played by a skillful hand. There are also creamy stalactites, vermicular tubes strangely intertwined, convoluted roots, mural gardens and galleries, gay and grotesque." A deep pit, the bottom of which is sixty feet or more below the entrance, is found in one side of the room, and the sound of a stream of water falling from a cleft in the ceiling and splashing on the rocks at the bottom of the pit is a pleasing break of the monotonous silence of the vast rooms through which we have come.

Once more bowing our heads to the inevitable, we crawled, squirmed, rolled and pulled ourselves through "Worm Alley" back into the main cave. Following our guide, we passed on through Josephine's Arcade, where a silhouette of the "Cave Queen," formed by a falling away of the white gypsum from the darker limestone, greeted us from the wall. "Indiana University Chapel" and the "Ball Room" succeeded and brought us to the "Junction Room" of the Long Route. Here the cave forks, one branch leading to the southwest and the other continuing northward to "Crawfish Spring" and Wabash Avenue. Taking the latter, we found it to be made up of a succession of halls, galleries and avenues, each with its own fanciful name and pleasing peculiarities, yet no place worthy of more than passing notice when taken in contrast with the grand scenes already described.

Crawfish Spring itself is formed from a small stream which flows through a cleft in the rock, and from it a trickling rill meanders on beneath the edges of the jutting walls to be soon lost to view beneath the roof which a few rods farther on comes down to meet the floor. Above the spring

is the passage known as "Wabash Avenue," which extends for several hundred yards in a northwesterly direction where it forks into a number of low and muddy branches.

Retracing our steps to the "Junction Room," we took the southwest passage, the first room entered being the "Frost King's Palace," eight feet high and twenty wide, where every object, great and small, is encrusted with sparkling crystals of gypsum. To one side is the "Bridal Chamber," and therein are found some of the finest of the gypsum rosettes for which the cave is noted. Several of these are four and a half inches in diameter, the slender crystals forming them having protruded from the pores in the magnesian limestone, and then, uniting into fibrous masses, have curved inward to form the *oulopholites*, or curl-leaved stones, each of which bears a close resemblance to a true rosette.

The "Ice House" is a rough-floored room where dripping water from the roof has covered the surface of the rocks with a film or coating of the thinnest and most translucent of calcite, resembling ice. Leaving the opening to the "Unexplored Region" on our left, we descended from the Ice Room into "Morton's Marble Hall," 1,100 feet in length, the sides and walls of which, in Collett's words, "are completely dressed in snowy whiteness, equaling the brightest marble halls of dreamland, song or story." Occasional nodules of jet-like flint are seen exposed along the walls and ceiling, and here and there are examples of the gypsum rosettes already mentioned. Beyond the "Marble Hall" is "Queen Mab's Marble Garden" and the "Fairy Palace," both of which have their walls covered with a gypsum efflorescence which has assumed the shape of flowers, leaves, sprigs and fanciful forms of many kinds. Beyond this end of Fairy Palace, 1,750 feet from the Ice House, are several low passages which visitors seldom enter, and from here we started on our return to the entrance of the cave.

The so-called "Unexplored Regions" opening from the Ice House and running north have been explored by guides, but visitors seldom pass within their portals. Washington Rothrock, the oldest and best known guide of the cave, has been through this portion several times as far as Rothrock's Island. The formations therein are said to be wondrously beautiful and more numerous than in many of the more thoroughly explored regions of the cave. A large series of specimens were obtained from some of these passages in 1893 for the World's Fair. A number of the larger passages of the Unexplored Region have not been penetrated as far as man can go, and some future explorer may, perhaps, find formations more beautiful and scenes more grand than those occurring in the better known portions of the cave.

The distance from Delta Island to Crawfish Spring, including Milroy's Temple, was estimated from pedometer measurements to be about one and four-tenths miles, and from the Junction Room to the end of Fairy Palace, about one-half mile.

The total length of the cave as traversed by the visitor who takes all three routes is, therefore, about as follows:*

Old Cave—from mouth to Senate Chamber.....	1.25 miles.
Short Route—from Fat Man's Misery, onward	1.06 miles.
Long Route—from Delta Island, onward.....	1.90 miles.
Total	4.21 miles.

ROTHROCK'S STRAITS. The writer and two of the guides passed through Rothrock's Straits in November, 1896. Dropping ourselves through the narrow cleft in Odd Fellows' Hall, we crawled down an angling passage over a mass of rough rocks and into a low room almost filled with fallen rocks. From this we crawled still farther down, climbing over great blocks of limestone and making our way beneath others partly loosened from the roof, until finally we reached the very bottom, probably seventy five feet below our starting point. Here we found another low room, with an earthen floor which had great cracks running through it in every direction, but with no signs that water had been present for centuries. From this a very low passage makes its way to near the Coons' Council Chamber, but there is no exit into that room. Retracing our way we took another route, and after much creeping, wriggling our way through dust, bumping our heads on the low ceiling, and with nothing in the way of interest to repay us for our trouble, we finally emerged on the side of the "Hill of Difficulty," and knew by experience that the Old Cave and the New are connected, and that the passageway between them is a very rocky road to travel.

EVIDENCES OF FORMER VISITORS TO WYANDOTTE CAVE. The first white men who visited Wyandotte Cave found evidences of its former inhabitancy by the Indians. Here and there throughout the Old Cave were pieces of hickory bark with their ends charred by fire—a sure sign of the previous visitations of man. Near the foot of one side of the great fluted "Pillar of the Constitution" was a large excavation, and scattered around the top and thrown over the sides of the hill which supports the pillar were many tons of debris quarried from the excavation. But little attention was paid to these features of the cave, and up to 1850 no record had been made of them.

The opening up of the New Cave furnished more plentiful evidence concerning these ancient visitors. The ceiling of Bat's Lodge, the small room first entered, was then black with smoke. Fragments of charred hickory bark strewed the floor, while moccasin tracks, now entirely obliterated, were plentiful. Hundreds of poles of sassafras, pawpaw, lin and other soft woods were found both in this room and in that portion of

* These distances are for one way only. In taking the Short Route, one travels in addition the distance from the entrance to "Fat Man's Misery." If the Long Route is taken on a different day, one travels in addition the distance from the entrance to Delta Island.

Rothrock's Straits nearest the New Cave. None of these poles had been cut with a sharp instrument, but all had been twisted from the parent stem or hacked there-from with dull stone axes. On the left side of the room was found a sloping bank of earth and sand in which bark, sticks, leaves and bunches of twisted grass were plentiful. Digging into this bank in November, 1896, numerous pieces of bunch grass, the inside bark of lin or poplar trees and short stems of weeds were found. According to Mercer,* these were "remnants of a store of fuel resorted to when the torches waned or a relight was needed."

Near "Pillared Palace" is a room where strata of jasper nodules abound in the walls and where numerous chips and splinters of jasper are abundant on the floor. Rev. H. C. Hovey first called attention to the fact that the supposed "bear wallows" of this room are depressions where, in the treacherous light of bark torches, the ancient workmen reclined while they worked down to partial finish the desired blocks of jasper. Numerous fragments of charcoal and large heaps of chips of jasper are about each depression, but though careful search was made by Mr. Hovey, later by Mr. Mercer, and still later by myself, no partially finished article of jasper was found. The fragments are mostly oblong, with the faces parallel, their dimensions being on an average about $4 \times 2 \times \frac{1}{2}$ inches. Several quartzite boulders have been found in the room, one of which is seen in the accompanying illustration to be lying on top of one of the pillars at the entrance of Pillared Palace.

The first explorers of the Long Route found in the passages beyond the "Junction Room" tracks of a small party of Indians who had wandered to and fro in that region. They had evidently entered by some as yet unknown opening, since the "Augur Hole," now the only means of entrance, was, when first discovered, entirely too small for the passage of a man. It is better, in my opinion, to consider that their means of entrance and exit has since been covered by fallen rock or, like that through "Fat Man's Misery," was hidden purposely by those ancient explorers, than to take the ground, as did Prof. Collett,† that the tracks were made 1,800 or 2,000 years ago, before the opening of the Augur Hole was so nearly closed as to prevent the passage of a man. These moccasin tracks were seen and noted by many of the early explorers, and low stone walls were put around them for protection, but the tracks have since been almost entirely obliterated by persons who, unmindful of the warnings of the guides, stepped over and upon them.

Up to 1877 it was generally supposed that the whites had made the excavation near the base of the Pillar of the Constitution in the Old Cave. Stelle, in 1864, wrote of it as follows:‡

*Proc. Am. Phil. Soc., xxxiv, 1895, 400.

†Geol. Surv. Ind., 1878, 467.

Wyandotte Cave, 69-70.



ENTRANCE TO PILLARED PLACE, WYANDOTTE CAVE.

“For fifty years the people of a civilized—aye, a Christian nation, have visited the Senate Chamber, not as admirers of the great God who has reared for himself such a magnificent temple, but as vandals. All the most interesting formations within their reach have been broken up or carried away; and even the great pillar itself has not been exempt from their attack, for an excavation has been made in its side which must have required days of hard labor, and from which large quantities of the purest white stone have been taken and scattered over the floor of the cave.”

Collett, in 1877, found three glacial boulders in the Senate Chamber, which, “from indications, such as wear and bruises, had been used as hammers or grinding pestles, and proved conclusively that that part of the Old Cave had been visited, if not occupied, by men of the Stone Age.” *

Rev. H. C. Hovey, in 1882, first claimed† that the excavation had been made by Indians “more than 1,000 years ago,” and that the “round or oblong boulders” of granite rock were the implements with which the ancient quarrymen wrought, being used “in breaking from this alabaster quarry blocks of a portable size and convenient shape.”

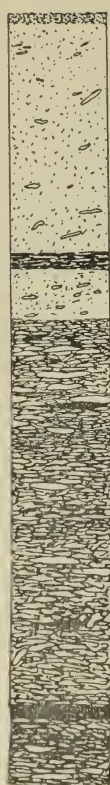
H. C. Mercer, in 1894, visited the quarry, and mentions the finding of a pick made of stag’s antlers, by Mr. Rothrock, and states that “the proof of Indian work at the spot was satisfactory and of a character never noticed and studied before the discovery of the site.” ‡

These constituted the recorded observations of the quarry when myself and party visited the place in July, 1896. It was noted at that time that the quantity of spalls and flakes of the material thrown over the side of the hill was very great, and that no digging had been done to discover the nature or thickness of the debris on top of the hill, nor to more fully verify the statement that it had been made by Indians. Our time being limited, no excavations were made at this visit, but on a subsequent one, in November, 1896, I secured the services of a workman and shovels and again visited the quarry. Careful measurements showed that above the debris a space eight feet long, six feet high, and five feet wide, or 240 cubic feet, had been quarried from the column. The top of the hill on which the column rests was found to be covered with an area 14 feet square of the debris, and through this, close alongside the base of the column, a trench was dug, eight feet long, three feet wide, and to the solid stalagmite beneath. It averaged four feet three inches in depth—*i. e.*, at that point the debris or pieces of quarried material and other matter was that thick. A perpendicular section through this trench disclosed the following:

*Geol. Surv. Ind., 1878, 467.

†Celebrated American Caverns, 140.

‡Proc. Am. Phil. Soc., xxxiv., 399.



1	1. Bats' dung.....	0.5 inch
	2. Ashes in a compressed, damp bed, with occasional flakes of stalagmite intermingled	14.0 inches
	3. Charcoal	1.0 inch
2	4. Ashes, with flakes of rock	3.0 inches
	5. Rectangular flakes of stalagmite or satin-spar, varying in size from an inch or two square to pieces 8x3x1 inches, or even larger, with occasional traces of charcoal intermingled.....	28.0 inches
3		
4	6. Charcoal	0.5 inch
	7. Flakes of stalagmite	4.0 inches
	Total	51.0 inches

Six quartzose bowlders, weighing from three to six pounds, were found scattered through the mass which we threw aside, two of them within a few inches of the bottom. They were worn with use, and on the surface of two or three of them were depressions which appeared to be fingermarks due to excessive use. At any rate, they must have enabled the workman to retain the rock hammer more firmly in his grasp.

Remains of five different deer's horns, which mostly crumbled when disinterred, and numerous small bones, also too much decayed to identify to what animals they formerly belonged, were found at intervals in the trench.

By digging in a few other spots it was found that an area 14x14 feet, on top of this hill and at the base of the column, was covered to an average depth of three and one-half feet with the particles of stone quarried. In addition to this, no less than twenty tons of the material had been pitched over the hill. Much, if not all, of this additional space was formerly occupied by stalagmitic material, the base of the column flaring outward on this side, and when the space already mentioned as having been quarried *above* the debris is taken into consideration, there is little doubt but that more than 1,000 cubic feet of the stalagmite has been broken loose.

A large quantity of wood must have been necessary to have produced such a bed of ashes as was found. The carrying this in over the seventeen rough hills and through narrow passes, through which one has to crawl and where more than a candle is a burden to the ordinary visitor, must have entailed a vast amount of labor and leads one to suppose that the material sought was used for a purpose deemed especially valuable. What that purpose was, I have not yet been able to ascertain, there being

few objects made of stalagmite among the "Indian relics" in any collection or museum in the United States.*

The deer's horns found in the debris were most probably used as wedges to pry loose the pieces of satin-spar after the latter had been cracked by the stone hammers. Such horns have been found in a number of caves of Europe, where ages ago they were put to similar use.†

The stalagmitic material on the summit of Monument Mountain in the New Cave was also quarried by these ancient visitors, but far less extensively than that in the Senate Chamber.

"Not inconsiderable must have been the danger of a long ramble in the cavern, when provided only with their primitive torches of hickory bark, and I can imagine that many precautions were taken in the way of shouted signals, of comrades left behind and of watches kept over a sort of reserve fire in 'Bat's Lodge,' when, venturing their lives on the chance of a rude firebrand that must never be allowed to go out, the red men quarried jasper and stalagmite in Wyandotte Cave."‡

FAUNA. Taking into consideration the size of Wyandotte Cave, its fauna can not be said to be an extensive one. Since it contains no large streams or pools of water, blind fishes are not found therein, and the specimens accredited to it by Cope and other writers, were all secured from much smaller neighboring caves.

Three vertebrates inhabit the cave in greater or less numbers. Of these the most common is the little brown bat, *Vespertilio subulatus* Say. In the winter season it hibernates in the cave by myriads, finding its way into the most distant recesses. In the "Senate Chamber" of the Old Cave it was abundant in November, while on the same date several specimens were found beyond Crawfish Spring, more than two miles from the entrance.

A form of the "white-footed" mouse, *Hesperomys leucopus* Raf., similar to that taken in Marengo Cave, occurs in small numbers, a dead specimen having been taken in Rothrock's Straits. The cave salamander,

*Since the above was in press I have received a letter from Dr. J. W. Powell, Director of the Bureau of American Ethnology, to whom samples of the material quarried were submitted, in which he says: "The specimen of stalagmite from Wyandotte Cave came duly to hand, and was submitted to an expert for chemical examination; this examination has been completed this morning, and indicates that the material is essentially pure carbonate of lime, the residue left on solution being too small for separate examination. It is of great interest to find that this cave deposit has apparently been worked extensively during prehistoric times. A few specimens of pipes, etc., carved out of white calcareous rock, presumptively stalagmite, are known, but there are not enough of these in the museums of eastern United States to indicate extensive quarrying of the material. It would be well to examine the collections of prehistoric material found in the vicinity of Wyandotte Cave with the view of ascertaining the extent to which the material was used locally by the aborigines. Researches in other districts demonstrate that, commonly, peculiar rocks available for primitive purposes were largely used locally, and that the use diminished in every direction from the natural center, finally leaving only a few sporadic examples, perhaps distributed to great distances."

† Mercer, *loc. cit.*

‡ Mercer, *loc. cit.*

Spelerpes maculicaudus (Cope), occurs in the first 150 feet, and is said to have been taken from the damp pit in Milroy's Temple; but careful search on both visits made thereto revealed no specimens. Several of the young of this or an allied species were found in the shallow muddy pools at the foot of the Throne in the Short Route.

Among insects, species of Diptera were rather plentiful. Two species of *Sciara* were secured, one in Creeping Avenue, the other near the Augur Hole, while three species of *Blepharoptera*, viz.: *defessa* O. S., *pubescens* Loew, and *specus* Aldrich were collected. *Phora nigriceps* Loew was found in numbers near the Augur Hole, and *Limosina tenebrarum* n. sp. was plentiful beneath loosely placed stones near "Fat Man's Misery."

Two species of Coleoptera, namely *Quedius spelæus* Horn and *Anopthalmus tenuis* Horn, both true cave forms, were taken, the former only near the Scuttle, beneath stones; the latter plentiful on top of Monument Mountain and near Crayfish Spring, and sparingly near the Throne.

A single moth, the only lepidopterous cave form taken, or hitherto recorded, was found in numbers between Bauditti Hall and Monument Mountain, flitting close to the earth, usually about the borders of the rooms.

The cave cricket, *Ceuthophilus stygius* (Scudder), was common in the crevices of the ceiling and walls of the first room of the cave, and a single specimen, said to have been taken from the top of Monument Mountain, was presented to me by one of the guides.

The Thysanuran, *Degeeria cavernarum* Pack., was very plentiful in damp places on the floor, especially where any organic matter was present; while the cave myriapod, *Pseudotremia cavernarum* Cope, swarmed over the moist summits of Capitol Hill and Monument Mountain, and was frequent in several other localities.

Belonging to the Arachnida six forms were taken, the most common of which was the cave harvestman, *Scotolemon flavescens* (Cope). The others were *Phanetta subterranea* (Em.), and *Meta menardi* Latr., both true cave spiders: *Chthonius packardii* Hag., a semi-blind pseudo-scorpion, occurring in small numbers on the sides of Monument Mountain and in Odd Fellows Hall, and two undetermined species of acarina or mites; one of which occurs on the wings of bats, both living and dead, and was undoubtedly introduced into the cave by those mammals.

Three species of crustaceans were taken in the cave, namely, the blind crayfish, *Cambarus pellucidus* (Tellk.), found sparingly in Crawfish Spring but not noted elsewhere; and *Crangonyx packardii* Smith, and *Cecidotæa stygia* Packard, both found in "Crawfish Spring" and in the rill running there-from, and also in the shallow pools at the foot of the "Throne" as well as in the "Pool of Deception" near its side. Specimens of a long, slender, whitish worm were also secured from the shallow pools at the foot of the "Throne."

Omitting the bat and mouse as not being cave residents, we place the list of animals taken by our party alongside of that listed by Cope from Wyandotte Cave in the Indiana Geological Report, 1872, 160, and find them to be as follows:

BLATCHLEY, 1896.

COPE, 1872.

VERTEBRATA.*

1. *Spelerpes maculicaudus* (Cope.)

INSECTA.

- | | |
|---|-------------------------------------|
| 2. <i>Anophthalmus tenuis</i> Horn. | 1. <i>Anophthalmus tenuis</i> Horn. |
| | 2. " <i>eremita</i> Horn. |
| 3. <i>Quedius spelæus</i> Horn. | 3. <i>Quedius spelæus</i> Horn. |
| | 4. <i>Lesteva</i> sp. nov. Horn. |
| 4. <i>Ceuthophilus stygius</i> (Scudder). | 5. <i>Raphidophora</i> . |
| 5. <i>Phora nigriceps</i> Loew. | 6. <i>Phora</i> . |
| 6. <i>Blepharoptera defessa</i> O. S. | 7. <i>Tipulid</i> . |
| 7. " <i>pubescens</i> Loew. | 8. <i>Anthomyia</i> . |
| 8. " <i>specus</i> sp. nov. | 9. <i>Machilis</i> . |
| 9. <i>Sciara</i> sp. ? | |
| 10. <i>Sciara</i> sp. ? | |
| 11. <i>Limosina tenebrarum</i> sp. nov. | |
| 12. <i>Degeeria cavernarum</i> Pack. | 10. <i>Campodea</i> . |
| 13. <i>Blabophanes ferruginella</i> Hbn. | |

MYRIAPODA.

- | | |
|--|---|
| 14. <i>Pseudotremia cavernarum</i> Cope. | 11. <i>Spirostrephon cavernarum</i> Cope. |
|--|---|

ARACHNIDA.

- | | |
|--|---|
| 15. <i>Scotolemon flavescens</i> (Cope). | 12. <i>Erebomaster flavescens</i> Cope. |
| 16. <i>Phanetta subterranea</i> (Em). | |
| 17. <i>Meta menardi</i> Latr. | 13. <i>Anthrobia</i> . |
| 18. <i>Cthonius packardii</i> Hag. | |
| 19. <i>Diplotaspis</i> sp. ? | |

CRUSTACEA.†

- | | |
|--|-------------------------------------|
| 20. <i>Cambarus pellucidus</i> (Tellk.). | 14. <i>Orconectes inermis</i> Cope. |
| 21. <i>Cæcidotæa stygia</i> Pack. | |
| 22. <i>Crangonyx packardii</i> Smith. | |

*Cope listed the blind fish from Wyandotte when in reality it was taken in Sibert's Well Cave, where I also secured a specimen. I therefore omit it from both lists.

†Cope listed among his Wyandotte crustaceans two additional species from neighboring caves, viz.: *Cæcidotæa micræcephala* Cope, a synonym of *C. stygia* Pack., from Salt Petre Cave; and *Cauloxenus stygius* Cope, a unique form, of which he took in "Sibert's Well Cave," a single specimen from the lip of a blind fish on which it is parasitic.

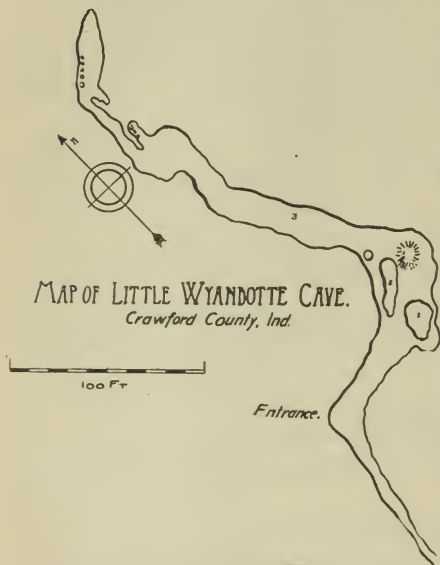
LITTLE WYANDOTTE CAVE.

The entrance to this cave is situated at the bottom of a sink hole about 300 yards from the front of Wyandotte Cave Hotel. The floor of the cave is about 20 feet below the bottom of the sink, and descent is made by a ladder placed in a well-shaped opening about three feet in diameter. At the bottom one finds himself in an entry which leads both to the right and the left. The right hand passage can be followed only about 75 feet, when it becomes too small for farther progress. It contains no feature of interest except a few stalactites.

The left-hand passage was found by actual measurement to be 340

feet in length. Passing "Pompey's Pillar," a large stalagmite, the first room entered was "Cleopatra's Palace," where there are hundreds of fine stalactites, which show grandly in the glare of the magnesium light.

Beyond this room two pits, said to be 60 feet in depth, shut off the further side of the cave. A narrow partition of slippery stone separates the two, and serves as a bridge to cross the chasm. On leaving this natural bridge, we made our way along the side of a steep ledge that skirts the left-hand pit, and then passed around a gigantic fallen stalactite, which



has been kept from rolling into the pit only by a friendly stalagmite against which it rests. Climbing a steep slope in which notches have been cut to serve as footholds, we enter a gallery, one side of the expanding mouth of which serves as a balcony above and partially around the deepest pit. On and above this balcony is a collection of cave formations of exceeding beauty and grandeur. A stately, fluted pillar, with its base expanding in broad-leaved masses of dripstone, thus forming a heavy folded curtain along the edge of the pit, is the giant of the group; while most unique of all is the "Corinthian Column," 10 feet high and less than three inches in diameter—a slender shaft of translucent snow-white satin-spar reaching from floor to ceiling. A number of fragile, tubular stems were clustered about the head of this pillar, each with a terminal drop of water, which glistened like a well-cut diamond in the light of our candles. Entering the gallery, in the words of Rev. Hovey:

"We wander on beneath a ceiling fretted with glistening pendants, amid pillars and pilasters, flying buttresses and interlacing arches, with here a cascade in mid-air transmuted into stone, and there a sculptured cell amid clustered columns." The cave finally ends in "Peri's Prison," where a narrow side gallery is separated from the main passage by a row of slender pillars, each but a few inches from its neighbor. All in all, Little Wyandotte is well worthy of visitation, and all those who wish to see the beautiful and at the same time experience a sense of the perils attending cave exploration should enter its bounds, cross the narrow bridge between the yawning chasms, and climb the slippery hill to the lovely gallery beyond.

FAUNA. Cave salamanders were plentiful in crevices about the walls of the descending shaft, and the cave cricket, *Ceuthophilus stygius* (Scudd.), was also taken in numbers in the same place. Other than these, no living forms were found except two myriapods, *Pseudotremia cavernarum* Cope. and *Scytonotus granulatus* (Say.), the latter an above-ground species, probably an accidental visitor to the cave.

SALTPETRE CAVE,

Crawford County, is located about one-third of a mile northwest from the mouth of Wyandotte Cave. The entrance, in a side of a ravine, is five feet high and 19 feet wide. Once within, a gigantic room expands, 220 feet long, 75 feet wide and 10 to 30 feet in height, with smooth, flat ceiling and earthen floor, the latter descending, and with its edges much encumbered with fallen rock.

Fragments of troughs, hoppers, vats and furnaces are still to be found, both in the cave and about its mouth, the sole remains of the saltpetre industry, carried on by Dr. Adams in 1812-15, an industry from whence the name of the cave was derived.

The one room comprises the cave, the only extension being a short passage in the right-hand corner of its farther end, where two openings extend upward through the ledges of limestone for 40 feet or more. A few stalactites occur about the edges of the ceiling, and in an alcove of the right wall, 50 feet from the entrance, are two columnar stalactites, six feet long and 20 inches in diameter, which have united from the center downwards, causing them to be dubbed with the fanciful name of "Siamese Twins."

FAUNA. The fauna of this large semi-subterranean chamber proved most interesting.

Bats by thousands were found therein in November, hanging head downward from the more remote and darker portions of the ceiling. Several specimens of the cave salamander were found in crevices near the mouth, while from similar localities were captured, in July, 50 or

more extra large adult specimens of the cave cricket. In November but one or two half grown examples of the same insect could be found.

Three species of Diptera were taken from the walls, namely: *Sciara* sp., *Psychoda minuta* Banks and *Blepharoptera pubescens* Loew. Two species of spiders, *Meta menardi* Latr., and a new form, *Tegenaria cavicola*, described by Banks in a supplemental paper, were taken from the ceiling, about 100 feet from the entrance. The harvestman, *Liobunum longipes* Weed., was also rather plentiful about the same distance.

That handsome autumn-emerging moth, *Scoliopteryx libatrix*, also evidently uses the cave as a winter abiding place, several specimens having been taken, November 5, from an alcove about 75 feet from the mouth.

In a wooden trough at the farther end of the room, used by the ancient "petre" workers to catch the drippings from a crevice in the roof, two crustaceans were secured, viz.: *Cecidotwa stygia* Packard* and *Crangonyx vitreus* (Cope), the latter not having been previously noted north of Mammoth Cave.

SIBERT'S WELL CAVE.

This cave is located at the foot of the ridge traversed in going from the Cave Hotel to Little Wyandotte Cave, and is distant about 200 yards from the mouth of the latter. To enter the cave one must climb down the stone walls of a well about 20 feet, when he will find himself close to the bed of a stream which flows rapidly to the southward towards Blue River.

On the right, or down stream, one can crawl but a few feet. Up stream, by crawling, stooping and wading, one can make his way for about 150 feet. With the exception of the animals which inhabit it, there is nothing of interest in the cave, it being merely a low, water-worn subterranean channel which is doubtless constantly but slowly increasing in size.

FAUNA. A single specimen of the blind fish, *Amblyopsis spelæus* De Kay, was taken from a deep pool near the center of this cave. Cope secured his specimens accredited to Wyandotte Cave from this pool, and Collett also records† the capture of a specimen here.

The cave salamander, *Spelerpes maculicaudus* (Cope), was found to be very plentiful close to the mouth of the cave, in May, 1895, and in July, 1896, more than a dozen being taken on each date. The cave cricket, *Ceuthophilus stygius*, was also taken on both occasions, being found in numbers within fifty feet of the bottom of the entrance. The blind crayfish, *Cambarus pellucidus* (Tollk.), occurs sparingly in the water, and a single specimen of the small, brown, eyeless beetle, *Anophthalmus tenuis* Horn,

*It was from this trough that Cope secured his specimens of *C. microcephala*, now regarded as identical with *C. stygia*.

†Ind. Geol. Surv., 1872, 153.

was taken from the damp floor over which it was crawling rapidly. Collett, *loc. cit*, records a similar beetle from this cave, and also the taking of a specimen of the blob, or "Miller's Thumb," a seeing fish, from a ripple in the stream.

EVASTON'S CAVE

is located about one and one-half miles northeast of Wyandotte, the entrance being at the bottom of a large sink hole. By crawling through a small opening and down a shelving slope of rock, we reached a water channel about three feet wide and eight to 20 feet high. We followed this up for probably 500 feet until it became too narrow for farther passage.

The stream which has eroded the channel is much smaller than that in "Sibert's Well Cave," and contains no deep pools. The cave was devoid of stalactites or other formations of interest.

FAUNA. No vertebrates, except a single bat which went flitting here and there before us, were noted. Two blind crayfish and several specimens of that small and common cave crustacean, *Caecidotæa stygia* Pack., were secured. The only other living form seen was an above ground myriapod, *Polyzonium rosalbum* (Cope), which was found beneath a loose stone about 50 feet from the entrance.

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Other caves there are in southern Indiana which we would gladly have explored and described had our time permitted. No two in the State are alike. Each is noted for some peculiar formation, room or passage which it possesses. In each and all can one see the results of the action of water—that greatest of nature's solvents and abraders, soft to the touch, gentle to look upon, its work of a day, a year, a century upon the solid limestone not appreciable to the eye—yet, by slow, unceasing action through the eons which have elapsed since that work began, it has carved every room and passage, constructed every pillar and stalagmite existing beneath the surface of southern Indiana.

THE FAUNA OF INDIANA CAVES.

BY W. S. BLATCHLEY.

In these days, when the great problem of evolution with its attendant factors of variation, adaptation, and distribution of species is foremost in the minds of all true scientists, the fauna of any region which is possessed of some peculiarity of climate, surface or other environment, becomes of especial interest. The total darkness and absolute silence which ever pervade the subterranean rooms and passages of caves have, in the course of centuries, proven potent factors in modifying the organs of

those animals which by accident have taken up their abode therein. Caves have, therefore, given rise to many so-called species which to the evolutionist are but links forged in the chain of evidence tending to prove the truth of the great doctrine which he espouses. Any facts relating to the habits, life history or distribution of cave animals are, therefore, of more or less value and inasmuch as several short papers have been prepared by specialists to whom the different groups of Insecta and Crustacea collected in Indiana caves were referred, it has been thought best to bring those papers together into one supplemental chapter under the above heading. To these papers have been added such notes concerning the abundance, distribution and habits of the different forms as were recorded by myself or assistants.

VERTEBRATA.

MAMMALIA (The Mammals).

By referring to the preceding notes on the fauna of individual caves it will be seen that a number of above-ground mammals resort to caves either for shelter or in search of food. Foxes, minks, weasels, raccoons, cats, bats and mice were the ones noted by our party, either as present in the caves, or by abundant "sign" to be frequent visitors thereto. Of these, the bats and mice are the only forms which spend much time in the caves, and therefore they are the only ones whose organs have become appreciably modified by subterranean life.

Foxes, *Vulpes vulpes* (L.) and *Urocyon cinereo-argentatus* (Schreber), resort to caves probably only for shelter, their dens and characteristic odor being noted in a number of the caves visited, usually within a few hundred feet of the mouth, but in Wyandotte back as far as Odd Fellows' Hall, a half a mile or more from the entrance.

The raccoon, *Procyon lotor* (L.), and the mink, *Putorius vison* (Schreber), frequent, for the most part, those caves which have streams flowing through them, and undoubtedly are on the search for crayfish and other aquatic forms which they are accustomed to find in their night prowls along the margins of surface streams. But one or two of the caves entered did not show signs of "coons," and the tracks of minks were seen in five or six.

Cats (*Felis domesticus* Schreber) and probably weasels, *Putorius erminea* (L.), frequent the caves in search of the mice and bats which are found therein. In Wyandotte Cave especially, do cats abound, their tracks and excrement being very common in the Old Cave as far as Odd Fellows' Hall, and in the New Cave to Monument Mountain. According to Mr. Rothrock a number of cats have taken up their abode in the cave, and bring forth and rear their young therein. They have exter-

minated the "rats" (*Neotoma*) mentioned by Cope and Packard as being inhabitants of the cave, and probably also any mice that may have formerly occurred in the cave. They now subsist wholly on the bats, and are said to have become so skilled in the capture of these flying mammals, that they leap as high as eight feet into the air for them and rarely miss bringing them down. Near the "Scuttle," at the time of our visits, were many remains of the wings and feet of bats, the cats having stationed themselves there and caught "on the fly," as it were, the bats, while the latter were winging their way through the narrow passage.

In the early part of the present century the Black or Cinnamon Bear (*Ursus americanus* Pallas) was a frequent resident of southern Indiana. Their "wallows" and claw marks are plainly visible in Eller's and Salt Petre caves, Monroe County, and Connely's Cave, Lawrence County. The first named cave was probably the seat of the sanguinary struggle described in the following letter which was received from Mr. R. M. Hazelett, an old and honored resident of Greencastle, Putnam County. From this letter one can learn something of the methods of cave exploration among the early settlers, as well as some of the dangers incident thereto.

GREENCASTLE, IND., July 16, 1896.

Prof. W. S. Blatchley, Indianapolis, Ind.:

DEAR SIR—I see from the papers that you, in company with other scientists, are contemplating making a trip of exploration to the caves of southern Indiana.

I feel interested in the exploration and description of a cave about five miles southwest of Bloomington, Monroe County, and have often thought I would at some time visit it, but I am now too old. My reasons for feeling anxious to see or have a correct description of the cave are these: There was quite an exciting circumstance took place in that cave in which my father, Samuel Hazelett, was a party. My father, in 1818, moved from Jackson County and settled in Monroe County, where I was born October 2, 1819, nearly seventy-seven years ago. In those days most men hunted and killed wild game more or less, and some were called "hunters" from the fact that they did little else but hunt for a living. One of these was James Wood. He could not write his own name but preached and hunted. He was out hunting one day when there was a "skift" of snow on the ground and he struck the trail of a bear which he followed to this cave. He thought he would not be beaten, so he went and got my father, who was rather more a farmer than a hunter, and William Smith and Henry Wood, who were considered hunters. They all resolved to go into the cave after the bear, and

prepared themselves by taking their guns, shot pouches, butcher knives, and flints and steels to make fire. They made also two sluts about as big and long as a man's arm. I reckon you don't know what a slut is. It is made by taking a large wick of some kind of cotton goods and squeezing tallow around the wick until the desired size is obtained. Then they started for the cave, and lit one of the sluts when they started in. After going in some distance they came to where the cave divided, one passage going to the left and the other to the right. There they lighted the other slut and placed it on the dividing point so that if they should get lost and get back there they would know where they were. They then took one of the passages, and after traveling some distance they came to quite a room with high ceiling and the floor about six feet lower than the passage. They went in on shelving rocks projecting over the floor around the outside edges of the room. These rocks allowed a man to squeeze around on about a level with the entrance without going down on the floor. They finally spied a bear at the opposite side of the room lying under these shelving rocks. My father took the slut and crawled around on these shelving rocks until he got over the bear so as to give James Wood a good chance to draw a bead on the bear. As Wood was considered the best hunter he did the shooting. At the crack of the gun the concussion knocked the light out, and there they were with a wounded bear in darkness they could almost feel. They had to grope their way back to where they had left their other slut burning. Father was the hindmost one getting back. He afterward said he felt like the bear was just behind him all the way.

After consulting for awhile, they concluded best not to go back into the cave where there was a wounded bear, so they took the other branch of the cave, and after traveling some distance they came to another room somewhat similar to the first one, only larger. They got down on the floor of this, and after getting pretty well across it they discovered another bear. He sneaked around as though he wanted to avoid trouble, but that did not meet the hunters' views, so Wood fired on him and wounded him just enough to enrage him. He came tearing at them, and they all broke for the outlet. Henry Wood stepped into a hole and fell down. The bear ran over him, and as he did so gathered up Wood's gun in his mouth and slashed it around as if he would break it to pieces. Henry Wood cried out, for God's sake, not to leave him. With that, father stopped and stayed with him. He said he would not have left him then if the bear had eaten them both up. James Wood and Smith both got up on the declivity, and as the bear made a rush to get out Wood gave him another fire that turned him, and as he came back father fired on him and that turned him. Thus they kept him going back and forth, Smith loading for Wood and H. Wood loading for father, until the bear's head was in a jelly; but he had gotten too mad to die. Finally H. Wood got a

chance to get out and left father alone, and he got back and laid down and crept under the ledge of rock as far as he could, pretending to be dead as much as possible, as he had always heard that a bear would not disturb a dead man. The bear came and put his nose to the back of father's neck and opened his mouth and let about a quart of blood run down his neck. He said he thought then that his turn had come, but the bear laid down against him without further molestation, only breathing his stinking breath where father had to breathe it. Hostilities had to cease until the bear saw proper to get up, which he did when he got ready. Then they soon dispatched him. His head was shot into a jelly. They skinned and quartered him, each one taking a quarter, and left the cave forever. They built up a fire and watched till day for the other bear to come out, but when day came they found by the tracks in the snow that he had come out and left. They then went to a neighbor who kept a pack of dogs, and got them and put them on the trail of the bear. They tracked him but a few miles until they found the bear dead, so they got them both.

I have never heard of the cave being further explored. The knowledge of it in the neighborhood may be very limited, as father moved from there to this place in 1824, and I suppose all the old settlers are dead or moved away.

Yours truly,

R. M. HAZELETT.

We next take up those species of mammals which were found to spend most of their lives in caves—namely, the mice and bats.

Family MURIDÆ (The Mice).

PEROMYSCUS LEUCOPUS (Raf.) White-footed Mouse. A form of this common above-ground mammal inhabits Marengo Cave and, possibly, several other caves, where mouse tracks and excrement were plentiful. Three were captured at Marengo, within 400 feet from the entrance, in cyclone traps set for the purpose. They differed much in appearance from above-ground specimens, having larger external ears (13 mm. long by 11 mm. broad), longer whiskers (38 mm.) and more protruding eyes. Dr. C. H. Merriam, to whom specimens were sent, did not, however, consider these variations definite enough to separate the form, even as a distinct variety. The mice have been noted ever since the cave was discovered, but seem to keep close to the entrance, through which, however, no light passes. In the winter season they are very destructive to sweet potatoes and pumpkins stored in the cave, and at other seasons evidently subsist upon the tallow drippings and other refuse matters left by the visitors.

One mummified specimen, which had evidently been dead a number of years, was obtained in Rothrock's Straits, Wyandotte Cave. A dozen traps were set for five nights in this cave, but none of them were molested.

Family VESPERTILIONIDÆ (The Bats).

VESPERTILIO SUBULATUS Say. Little Brown Bat. This, the most common bat inhabiting Indiana, was found in small numbers in almost every cave visited. In the winter season they are said to be much more abundant, flocking by thousands to the caves for shelter, and there passing the winter, hanging head downward and in a state of comparative torpor, for months in succession.

A second visit to Wyandotte in November gave a better idea of the immense numbers which hibernate in that cave. As one passed along through the rooms and passages, their low squealing notes could be heard on every side, being the only sound which broke the death-like stillness. This squealing note was uttered only as we passed along, the light from the candles evidently disturbing those which had not yet entered their winter torpid state. Two other sounds they seemed capable of making, one, the cry of a single bat in rapid, broken notes, resembling the song of a robin in a minor key; the other, a noise somewhat similar to the short, quick alarm note made by the common ground squirrel, *Tamias striatus* (L.), when it espies some intruder on its domain.

The bats choose as a resting place that part of the roof where small portions have begun to flake, giving a certain degree of roughness, or small crevices, to which they can cling. They can not attach their claws to a smooth surface, hence from large portions of the roof of a room they may be entirely absent. In places where they find a suitable foothold they congregate so closely together that it is difficult to pull one from the midst of a group. On a low ceiling in Salt Peter Cave, Crawford County, an area, one foot wide by one and seven-tenths feet long, was measured, and the bats thereon were pulled off one by one and counted. Their number was 401 on the one and seven-tenths square feet.

When pulled or knocked loose from the roof they fall to the floor, where they lie motionless for some time, and then begin to flutter and crawl about, finally becoming lively enough to fly and find a new resting place.

They show a remarkable sense of direction in their flight, passing, in a darkness so profound that man can see absolutely nothing, swiftly and unerringly through openings but a foot or two in diameter, without hitting the walls. The direction of flight seems to be, however, one of instinct or training rather than of reason, since when a door was first put in the

opening at the end of the "Scuttle," through which they had been wont to pass in numbers, they flew blindly against it and were killed by thousands.

The odor which the bats give off is a disagreeable one. At Wyandotte in summer it is not noticeable since their numbers are then few. In winter it is recognized immediately one passes into the main portion of the cave. Here, as elsewhere, the bats pass in numbers into the deepest recesses, being found abundantly in the Senate Chamber and sparingly near Crawfish Spring, two miles or more from the entrance. Several questions of interest, which to my mind are unanswered, arise regarding the cave life of these animals:

First. In a cave where the temperature is 54° F. the year round, how do they determine when warm weather has begun out of doors?

Second. How do those which spend the days of the summer season in the cave determine the approach of dusk?

Third. How do they distinguish in the intense darkness those portions of the roof which are smooth from those which are rough enough to furnish a foothold?

As is well known, bats are crepuscular in habit. They spend the day in darkness and the night in search of food. Such habits have, in the course of ages, rendered their eyes exceedingly small, their external ears large, their flight, like that of owls and whippoorwills, noiseless. Mr. Rothrock reports an occasional albino bat among the thousands hibernating in Wyandotte Cave; and also a larger, reddish brown species, probably *Atalapha noveboracensis* (Erx.), as being occasionally seen.

BATRACHIA (The Frogs and Salamanders.)

Family PLETHODONTIDÆ.

- SPELERPES MACULICAUDUS*, (Cope.) Cave Salamander.
Gyrinophilus maculicaudus Cope. Am. Nat., XXIV, 1890, 967.
 Butler, Journ. Cin. Soc. Nat. Hist.,
 XIV, 1892, 170.
Spelerpes maculicaudus, Hay, Am. Nat., XXV, 1891, 1133.
 Id., Indiana, Geol. and Nat. Hist., XVII,
 1891, 447.

This handsome salamander, which was described from specimens taken from springs at Brookville, Indiana, was found to occur in the following caves: Porter's, Donnehue's, Donnelson's, Clifty, Marengo, Salt Petre, Little Wyandotte, Wyandotte and Sibert's. It will doubtless be found in all others which contain streams of water or damp rooms near the entrance. It has also been taken by myself in a sandstone cave at Indian Springs, Martin County, and by W. P. Hay at May's Cave, Monroe County, and Kern's Cave, Lawrence County.

It is usually found within 150 feet of the entrance, clinging to the walls, especially in crevices and crannies just above flowing streams or pools of water. In Wyandotte it is said by the guides to be found occasionally in Milroy's Temple, one and a half miles from the entrance. If so, it must come down through a crevice in the roof. At Sibert's Well Cave it was abundant both in May, 1895, and July, 1896, as many as 20 specimens having been secured on each visit.

While its eyes appear as large and normal as those of allied terrestrial species, its sense of sight seems to be limited. It remains quiet when discovered and shows little fear until touched, when it scrambles deeper into the crevice or beneath some fallen rock on the floor. Even when a candle is put within a few inches of its head it does not move until it feels the heat.

The body of *maculicaudus* is somewhat stouter than that of *longicaudus* (Green). The tail of the former, while of about the same proportional length, is less wide and less compressed. The ground color of *maculicaudus* is in life a bright orange yellow, approaching in some specimens a vermilion. The black spots on the back and sides are very numerous and vary much in size and shape, but never coalesce to form vertical bars on the sides of body and tail, though in a specimen from Donnehue's Cave they unite on the sides of body to form horizontal bars, equal in length to the width of the intercostal spaces.

The largest specimens taken were from Donnelson's Cave, Lawrence County, and gave the following measurements: Total length, 156 mm.; snout to cloaca, 61 mm.; snout to gular fold, 15 mm.; width of head, 10 mm.; length of fore limb, 16 mm.; of hind limb, 17 mm.; of tail, 80 mm.; distance from axil to groin, 35 mm.

Several immature specimens, probably of this species, were taken from shallow pools in Mayfield's Cave, and in Wyandotte near the "Throne." They were olive gray in color, mottled with irregular rows of small rounded yellow spots on the back and sides. The adults must, at the spawning season, find their way back as far as these pools or enter the cave through some near-by crevice.

Contrary to Cope and Hay, I do not regard the adults of *S. maculicaudus* as aquatic. While all the specimens noted in the caves were in damp rooms and usually within a few feet of water, none were in the water. In Monroe County, in 1886, I took two specimens from beneath logs a mile or more from any known cave, and half that distance from streams or springs. They were wrongly referred to *S. longicaudus* (Green), a species that I have since found in numbers in pools, beneath flat rocks in the bed of a stream in Putnam County, and also in Vigo County.

In Jordan's Manual of Vertebrates, *S. longicaudus* is given the common name of "Cave Salamander." I have never seen it in caves, nor

do I believe that it frequents them, there being no record to that effect. *S. maculicaudus* probably occurs throughout the limestone regions of southern Indiana and Kentucky; but as yet no specimens have been recorded, except from this State.

Family RANIDÆ.

RANA CLAMATA Daudin, Green Frog. A specimen of this common terrestrial frog was taken in a cave near Mitchell, Lawrence County, 450 feet from the entrance. It was evidently following up the stream found in the cave, and was without doubt an accidental visitor.

PISCES. (The Fishes.)

Family AMBLYOPSIDÆ. (The Blind Fishes.)

AMBLYOPSIS SPELÆUS, DeKay. Blind Fish.

DeKay, Zoöl. New York, IV, 1842, 1-7.

Putnam, Am. Nat. VI, 1872, 10, Pls. I and II.

Jordan and Gilbert, Syn. N. A. Fishes, 1883, 324.

Hay, Indiana Geol. and Nat. Hist., XIX, 1894, 234.

Jordan and Evermann, Fishes of N. Am., 1896, 706.

Of the five species of cave fishes recognized as belonging to the fauna of the eastern United States, this is the largest, yet specimens of it are seldom, if ever, more than five inches in length.

It was found in but three of the caves visited; namely, Sibert's Well Cave, where a single specimen was secured, and in two small caves three miles east of Mitchell, Lawrence County, where 24 specimens were taken. It has been recorded from Sibert's cave by Collett and Cope; from Clifty caves and a cave four miles west of Orleans, Orange County, by Dr. John Sloan; and from Donnelson's and Hamer's caves, Lawrence County, by Collett.

In that portion of Sibert's Cave large enough for exploration, there is but one pool which the fish inhabits, and usually but one or two are found therein. Whether the species breeds in this pool, or in some distant portion of the cave is as yet unknown.

In the Lawrence County caves the species seems to be common, though never more than two and seldom but one were seen at a time. They move very slowly through the water, usually near the surface and close to the edges of the deeper pools which they inhabit. They are wholly non-sensitive to light, but extremely sensitive to touch or any jar or motion of the water. They were readily caught by putting a dip-net very gently into the water a foot or two from them and then making a quick for-

ward and upward scoop. If in still, deep water, they seem to glide, or rather float, on and on, propelled by a scarcely perceptible motion of the caudal fin. One must think of them as ever surrounded by an intense darkness, the prey of every fish-loving animal, as mink or coon, that can swim and see in the darkness, the white skin of the fish readily revealing its presence if the least gleam of light reflects from its sides. No external trace of eyes are to be found in adult specimens, but the loss of sight is in part compensated by numerous tactile papillæ, arranged in ridges on the sides and front of the head.

Of these fishes Cope has written as follows: *

“If these Amblyopses be not alarmed they come to the surface to feed and swim in full sight, like white, aquatic ghosts. They are then easily taken by the hand or net, *if perfect silence is preserved*, for they are unconscious of the presence of an enemy except through the medium of hearing. This sense is, however, evidently very acute, for at any noise they turn suddenly downward and hide beneath stones, etc., on the bottom.”

My observations of the specimens taken do not bear out the above statement. We talked and even hallooed close to the fish without causing them to take alarm, but the least movement of the water frightened them, and they darted rapidly away, usually at right angles to the course they were pursuing. The sense of touch, rather than that of hearing, is, in my opinion, the one which has been intensified by long residence in the dark and silent recesses of the caves.

In several instances, as the dip net was raised quickly upward, the fish would leap several inches above the surface of the water in a vain endeavor to escape. In one place in Lawrence County a stream flows out of a cave and through a deep ravine for about 200 yards, and then enters another cave. In both caves the blind fish were captured within 100 feet of the openings, and there is little doubt but that they make their way through the open stream from one cave to the other. The caves and subterranean streams of southern Indiana doubtless form a more or less complete system of subterranean drainage, and through this the blind fish finds its way wherever the water is deep enough to allow it passage.

In captivity this fish eats very little. Dr. Sloan, of New Albany, has kept specimens in an aquarium for 20 months, and says: “They have taken no food, except what has grown up in the water and on the sand in their tank.”† “Some of them would strike eagerly at any small body thrown in the water near them, rarely missed it, and in a very short time ejected it from their mouths with considerable force. I often tried to feed them with bits of meat and fresh worms, but they retained nothing.

*Geol. Surv., Ind., 1872, 162; 1878, 494.

†Packard, Cave Fauna of N. Am., 1889, 24.

On one occasion I missed a small one and found his tail projecting from the mouth of a larger one; I captured and released him.*

In nature they doubtless feed upon one another and upon the blind crayfish and smaller crustaceans which inhabit with them the streams of caves. A number of those captured were "nosing," as they slowly swam, the rocks along the sides of the pools, and it is possible that they gather some organic matter from the slime on these rocks.

The measurements of the largest specimen taken were as follows: Length, four and a half inches; head, three in length; depth, four and a half in length. The color is white, the scales are very small, and the young are born alive.

A second species of blind fish, *Typhlichthys subterraneus* Girard, is said to occur in some of the wells and subterranean streams of southern Indiana, but as yet no definite localities have been recorded.

INVERTEBRATA.

INSECTA.

Representatives of Diptera, Lepidoptera, Coleoptera, Hemiptera, Orthoptera, Thysanura, Myriapoda and Arachnida were secured in the caves visited. The members of each order were sent to different specialists, as follows: The Diptera to J. M. Aldrich, Moscow, Idaho; the single Lepidopteron to Miss Mary E. Murtfeldt, Kirkwood, Mo.; the Coleoptera to H. F. Wickham, Iowa City, Ia.; the Hemiptera to E. P. Van Duzee, Buffalo, N. Y.; the Myriapoda to O. F. Cook, Washington, D. C.; and the Arachnida to Nathan Banks, Sea Cliff, N. Y.

Messrs. Aldrich, Wickham and Banks (in part), and Miss Murtfeldt have prepared papers, which are presented herewith, with supplemental notes added by myself, on habits, etc. Messrs. Van Duzee, Cook and Banks identified the species sent, and the papers as presented were prepared by me. To all the parties mentioned I am under especial obligations for the work done on the specimens submitted.

*Packard, *loc. cit.*, 127.

ON A COLLECTION OF DIPTERA FROM INDIANA CAVES.

BY J. M. ALDRICH.

This collection embraces 12 species, of which five are herein described as new, one constituting a new genus. Two species are only generically determined. The family Mycetophilidæ is represented by five species, Helomyzidæ by four, and Psychodidæ, Borboridæ and Phoridæ by one each. The Helomyzidæ furnish by far the greater number of individuals. It does not appear that any of these species are wholly confined to a cave life. They show no marked peculiarities of structure and are probably found in shady places generally. None of those previously described, except *Blepharoptera defessa*, have been heretofore known to inhabit caves.

1. MACROCERA HIRSUTA Loew.

Loew, Centuries IX, 5.

One specimen, Truett's Cave, July 9. Slightly larger than Loew's type, thoracic dorsum and pleuræ more infuscated; halteres brownish at tip. Described from the District of Columbia. I have no knowledge of any captures of the species since that time till now.

The specimen noted was taken on the wing in the main room of the cave, 800 feet from the entrance.—W. S. B.

2. SCIARA SPP.

Two species, both small. Of the first, which is dark with a shining black thoracic dorsum, there are seven specimens, six from near the mouth of Salt Petre Cave, the other from Wyandotte Cave. November 5, 1896. Of the second, which is lighter with yellowish brown thorax, one specimen is from Donnehue's Cave, July 14; another, Wyandotte Cave, near Augur Hole.

The specimens of *Sciara* were in all instances taken in small crannies in damp portions of the cave. The "Augur Hole" of Wyandotte is about three-fourths of a mile from the entrance. Species of the genus are quite common in Mammoth Cave, Kentucky, and the young, according to Osten Sacken, live on decaying vegetable matter, fungi, etc.—W. S. B.

3. MYCETOPHILA UMBRATICUS n. sp.

Female. Front dark brown; palpi and three basil joints of antennæ yellow. Thorax clay yellow, somewhat pruinose with white, the dorsum somewhat infuscated and provided with numerous stout black hairs along the sides; scutellum and metanotum also brownish, the former with two

distinct hairs. Abdomen brown, compressed, the distal part of each segment with a lighter ring, which is broader underneath. Legs pale yellow with a distinct fuscous tinge. Coxæ paler, the front ones with only a few fine hairs at tip; tibiæ wholly without spines except at tip, still on the posterior ones a few scarcely perceptible setulæ. Tarsi elongated, uniformly infuscated, slightly darker than the tibiæ; in the front leg the entire tarsus is about *four times* the length of the tibia, in the middle leg two and a half, and in the hind leg one and a half times. The tibial spurs on the front leg are a fifth the length of the metatarsus; on the other legs a third.

Wings without maculæ, tinged with yellow along the costa and to a less degree all over the apical half. Venation as figured.

Length, 5.2 mm.; of wing, 4.5 mm.

One female, Shiloh Cave, July 15.

The specimen was taken from beneath a rock about 300 feet from the entrance. A member of the genus has been recorded by Osten Sacken from Bradford Cave, 16 miles from New Albany, Ind. The larvæ live in fungi.—W. S. B.



Wing of *Mycetophila umbraticus* n. sp.

ODONTOPODA, new genus.

(ὄδους tooth; ποὺς foot.)

(Mycetophilidæ near Glaphyoptera.)

Ocelli three, all large, nearly in a straight line; antennæ 16-jointed, the two basal joints distinct, the others cylindrical, the third longest; palpi four-jointed, first short, second a little longer, third longer than the two preceding, fourth a trifle shorter; coxæ elongated; abdomen (male) long, slender, clavate, composed of seven distinct segments besides the hypopygium. Wings, fourth longitudinal arising near the base; third vein not branched; costal vein not extending beyond tip of third longitudinal; fifth vein forked; auxiliary vein ending in the costa almost half way to the apex; small crossvein nearly equal in length with the first segment of the third vein; fourth vein with a very thin anterior branch arising at the origin of the crossvein, or seemingly from the crossvein itself.



Wing of *Odontopoda sayi* n. sp.

4. ODONTOPODA SAYI, n. sp.

Male. Front black, antennæ brown, except the first three joints, which are yellow; mouth parts yellow; thorax and coxæ yellow, rather pale; the dorsum, however, more acorn-colored without distinct lines. Abdomen brown, the bases of the segments and a larger part underneath of

a lighter color; seventh segment distinct, nearly as long as the sixth, hypopygium as long as the seventh, first segment over half as long as the second. Femora and tibiae yellow, with a brownish tinge; front tarsi black (the others wanting, but doubtless black). Wings of a clear yellow tinge, lighter posteriorly; third vein with a rather strong curvature.

Length, 6 mm.; of wing, 4.7 mm.

One male, Marengo Cave.

The single specimen was on the side of a damp rock, 400 feet from the entrance.—W. S. B.

5. *PSYCHODA MINUTA* Banks.

Banks, *Canad. Ent.*, XXVI, 331.

One specimen, Salt Peter Cave, Crawford County.

6. *ULOMORPHA PILOSELLA* Osten Sacken.

Osten Sacken, *Proc. Acad. Nat. Sci. Philadelphia*, 1859, 342

Osten Sacken, *Monograph N. A. Dipt.*, IV, 233.

One specimen, Porter Cave.

7. *BLEPHAROPTERA DEFESSA* Osten Sacken.

Osten Sacken, *Bulletin U. S. Geol. and Geog. Survey*, Vol. III. No. 1, p. 168, note.

One female, Wyandotte Cave.

By the kindness of Professor Packard, I was enabled to see the description of this species. The following sentence is at the end of the description: "*Blepharoptere* are often found in caves, where they are said to breed in the excrement of bats." The description occurs as a footnote to an article by Professor Packard on "A New Cave Fauna in Utah," but the specimens described were from Hundred Dome Cave, near Glasgow, Kentucky, and were also reported from Wyandotte Cave, among others.

This is the *Anthomyia* of Cope's "Fauna of Wyandotte Cave." *Ind. Geol. Surv.*, 1872, 160. For description and figure see also, Packard's "Cave Fauna of North America," 1889, 80.—W. S. B.

8. *BLEPHAROPTERA PUBESCENS* Loew.

Loew, *Centuries II*, 82.

Seven specimens, both sexes: Shiloh Cave, July 15 (1); Salt Peter Cave (2), Coon's Cave (2), Porter Cave (1), Wyandotte Cave (1).

The species was described from Massachusetts.

9. *BLEPHAROPTERA LATENS* n. sp.

Brownish-black, head, knees, venter and tip of abdomen reddish; two vibrissæ each side.

Head dark red, rather variable in color, vertical triangle black, second fronto-orbital bristle a trifle smaller than the preceding; antennæ dark red, third joint more or less infuscated; face and mouth parts dark red; two large vibrissæ on each side, one a little longer than the other, a narrow strip only is bare below the eye, the remainder of the cheek with rather coarse black pubescence; occiput black above. Thorax black, the roots of wings, halteres and pleural sutures red or yellowish-red; scutellum and mesopleuræ bare, hypopleuræ with a group of four ascending bristles near the upper edge, otherwise bare on the sides except for a little very small scattering black pubescence; underneath, between the fore and middle coxæ, are very numerous bristles. Abdomen black, its tip, the venter, and usually the posterior margin of each segment red. Coxæ and femora black, hairy, the latter stout; trochanters and knees red; tibiæ usually with a considerable red or reddish yellow, especially near the middle; tarsi almost uniformly brown. No special long bristles on the legs. Wings without spots, slightly yellow, the costal bristles small.

Length, 5 to 5.5 mm.; of wing, 4.5 to 5 mm.

Nine specimens, both sexes: Donnehue's Cave, July 14 (3); Shiloh Cave, July 15 (1); Porter Cave, (2); Mayfield's Cave, July 9 (3). Two of the specimens have numerous mites attached to the body.

10. BLEPHAROPTERA SPECUS n. sp.

Cinereous, largely yellow, scutellum pubescent.

Head yellowish, vertical triangle and upper part of occiput black, second fronto-orbital bristle smaller than first. Antennæ far apart, yellow, third joint somewhat darker, one vibrissa, the small hairs behind it confined to a narrow strip close to the oral cavity. Dorsum of thorax brown, about the edges more yellow; humeri, the posterior part and the scutellum usually entirely yellow, scutellum with distinct black pubescence besides the usual bristles. Pleuræ yellow with a darker color on the meso and hypopleuræ, the former part bare, the latter with one ascending bristle above and almost imperceptible sparse black pubescence, underneath a few bristles; tegulæ and halteres yellow. Abdomen on the basal half quite blackish, overlaid with cinereous dust, toward the tip yellow; male hypopygium large. Legs principally yellow, but varying in different individuals. In both sexes a row of six or eight bristles in front near the tip of the middle femur; in male a similarly placed row, but higher up, on the hind femur, numbering four or five. Wings slightly yellow, the costal bristles large.

Length, 3.5 to 5 mm.; of wing, the same.

Eighteen specimens, both sexes: Eller's Cave (3); Porter Cave (11); Mayfield's Cave, July 9 (2); Donnehue's Cave, July 14 (1); Wyandotte Cave (1).

The species of *Blepharoptera* were the largest and most common *Diptera* noted in the caves. They were found in the damper portions of nearly every cave vis-

ited, on the walls and roof. They were never noted on the wing, except when disturbed, when they would fly but a short distance before alighting. The large species were about as long as, but more slender than, the common house fly. The larvæ, according to Osten Sacken, live in fungi and the excrement of bats.—W. S. B.

11. *LIMOSINA TENEBRARUM* n. sp.

General color throughout, dark brown, sub-shining. Front, face, edge of clypeus and proboscis the same, the last at the tip yellowish; third joint of antennæ rounded, arista slender, microscopically pubescent. Dorsum of thorax with moderate bristles; scutellum concolorous, with four bristles; pleuræ with a little yellow along the sutures; halteres yellow. Legs of simple structure; the tibiæ a trifle lighter than the femora, their tips and the tarsi yellow; hind metatarsus but little thickened, two-thirds of the length of the following joint.

Wings as figured. The last section of the third vein perfectly straight, the fourth beyond the posterior crossvein becoming extremely thin, yet traceable to the margin; second and third sections of costal vein subequal. The wings are moderately tinged with brown.



Wing of *Limosina tenebrarum* n. sp.

Length 2 to 2.1 mm.; of wing, 1 to 1.3 mm.

Ten specimens, both sexes; Truett's Cave, July 9 (2); Donnehue's Cave, July 14 (2); Clifty Cave (1); Marengo Cave (1); Wyandotte Cave (3); same, near Augur Hole (1); same, November 6, 1896 (1).

The venation will readily distinguish the species.

The specimens from Donnehue's and Clifty caves were taken from piles of half dry excrement of the raccoon. Those from Wyandotte from beneath stones in the vicinity of remains of dead bats near the "Scuttle." The insects leap a few inches, rather than fly, when disturbed.—W. S. B.

12. *PHORA NIGRICEPS* Loew.

Loew, Centuries, VI, 99.

Nine specimens, Wyandotte Cave, near Augur Hole.

Taken from the mouldy remains of bread, chickens, etc., near the "Augur Hole," three-fourths of a mile from the mouth, July 27, 1896.—W. S. B.

LEPIDOPTERA.

Family TINEIDÆ.

The discovery of the fact that a small Tineid moth is a common resident in Wyandotte Cave was one of the most interesting results of our study of the cave fauna of Indiana, since no other instance is on record of a member of the order of Lepidoptera being an inhabitant of caves.

Specimens were sent to Miss Mary E. Murtfeldt, of Kirkwood, Mo., who has made a special study of the Tineid group, and she kindly prepared the following paper on the species:

A CAVE-INHABITING MOTH.

 BY MARY E. MURTFELDT.

BLABOPHANES FERRUGINELLA Hbn. Specimens of the above named Tineid, with a number of its pupal cases, were recently received for determination from Prof. W. S. Blatchley, State Geologist of Indiana, who gives the following interesting account of its habits: "This insect was found quite abundantly in Wyandotte Cave, 1,000 feet or more from the entrance, in the vicinity of the remains of dead bats and other decaying animal matter, including the dried excrement of cats. Quite a number of the latter inhabit (or frequent?—M. E. M.) the cave and catch the bats as they go in and out of the small openings known as 'Fat Man's Misery' and the 'Augur Hole.' The moths seldom fly, but crawl very rapidly, or leap short distances when disturbed."

In a succeeding letter, Professor Blatchley remarks: "I have Dr. Packard's monograph on 'The Cave Fauna of North America,' but can find no mention of a Tineid or any other moth being found in the caves. Wyandotte Cave has been pretty thoroughly explored before, especially by Professor Cope in 1872, but he also says nothing of moths among its fauna. I have made three visits within the past two years. The first time I took only one moth, but at that time was sight seeing rather than hunting insects. The second and third times I went on more serious business and found the moths plentiful." * * * *

Following Professor Blatchley's lead, I also looked through all the literature accessible to me on the subject of cave insects, but without finding any reference to any species of Lepidoptera.

The species received from Professor Blatchley not being represented in my collection, was sent for determination to Dr. C. H. Fernald, of Amherst, Mass., our leading authority on the Micro-lepidoptera, who pronounced it *Blabophanes (Tinea) ferruginella* Hbn. As Professor Blatchley suggested, it was first described in this country by Dr. Clemens as *Linea croceicapitella*. Clemens' description does not appear to me to apply very closely to the typical form of *B. ferruginella*, and it would seem that it was not at the time recognized as the latter species by Mr. Staniton, then the highest English authority on the Tineidae, but the type in the Philadelphia collection established the identity.

Both Mr. Chambers in his "List of North American Tineina," and Professor Riley in the more recent Smith "List of American Lepidoptera," discard the genus *Blabophanes* as not sufficiently distinct from *Tinea*;

but Professor Fernald concurs with contemporary European authors in regarding the scaleless discal spot, in connection with some less conspicuous characters, as of generic value. So far as I have been able to ascertain, no account of the habits or life history of this species has ever been published in this country. It is not included among the species commonly grouped as "clothes moths" by either Drs. Fernald or Riley in their synonymical and popular papers on these species, nor is it mentioned in Mr. Howard's recent bulletin on "Household Pests," and yet it probably occurs where furs and pelts are stored. Indeed, its presence in the depths of the cave can best be accounted for by its accidental introduction on the clothing of guides and visitors.

The species expands from 14 to 18 mm. Length of body, five to seven mm. Head with dense tuft of rust-red hairs. Fore wings oblong, with rounded apex, silky, grey brown, with slight violet tinge in fresh specimens; a broad ochreous or buff stripe extends along the inner edge, forming a conspicuous dorsal stripe when the wings are closed; discal spot translucent, dingy white. Under wings shining, pale gray-brown. Both wings with long, yellowish gray fringes. Larvæ not observed—probably resembling those of the other case-making species. Pupal cases densely felted, dark gray, subcylindrical, truncate, varying in length from six to eight mm.

Heinemann says that in Europe this species is on the wing during June and July, and again in autumn, indicating two summer broods. It would be interesting to ascertain how far its habit in this respect has been, or would be modified by the unvarying temperature and food conditions of cave existence.

The occurrence of this moth in Wyandotte Cave can not date back many years, for it surely would not have escaped the notice of Drs. Packard and Cope, when their researches were made.

As yet, the species shows no organic or colorational departure from the open air type, but it is not unreasonable to suppose that in years to come there may be perceptible modification in these respects, as has been observed in other cave inhabiting forms.

On the occasion of my first visit to Wyandotte, May, 1895, but few of the moths were noted, and but one was captured. In July, 1896, they were frequent, and in November, 1896, quite common, especially about the "Scuttle," and as far back as "Monument Mountain."

The pupal cases were found attached to small projections of the wall, close to the floor, or on the under side of stones which rested loosely on the floor. In all instances they were in close proximity to decaying remains of bats or other refuse.

The introduction of this European moth into a cave like Wyandotte, and its rapid adaptation to the peculiar environment there found, is an excellent proof of the now commonly accepted theory that all cave animals are but the descendants of seeing forms, which, in the past, have thus accidentally found their way into caves.—W. S. B.

COLEOPTERA.

Mr. Wickham's paper, annotated by me is as follows :

ON A COLLECTION OF INDIANA CAVE BEETLES.

BY H. F. WICKHAM.

The species of cave beetles resulting from the recent explorations are few in number, but several are of considerable interest and add a great deal to our knowledge of the local distribution of life in the Indiana caverns. Several are common epigæal forms, no doubt attracted by the opportunity for shelter or washed in by rains, while others are truly cavernicolous, and partake of the peculiarities in color and development of the visual organs so often exhibited by cave insects.

Attention may be called to the discovery of the blind larvæ of *Quedius spelæus* Horn, the adult having been originally described from Wyandotte Cave. Additional material has also been obtained of *Anophthalmus tenuis* Horn, first collected in the same locality as the *Quedius*.

A detailed report on the material is submitted below :

Family CARABIDÆ.

SCARITES SUBTERRANEUS Fabr. Syst. Eleuth. I, 124. Say, Tr. Am. Phil. Soc., II, 17. Ent. Works, Lec. Ed., II, 448. *Substriatus* Hald., Proc. Acad. Nat. Sci. Phila., II, 54.

This common but variable species has been described under about a dozen names by Le Conte, Chaudoir, and Bonelli, in addition to the ones cited above. A specimen of the form, *substriatus* Hald., was taken by Mr. Blatchley in Porter's Cave. Very widely distributed in North America, from Atlantic to Pacific coasts, and south to Lower California. Usually found under boards or stones ; often exhumed in digging gardens.

ANOPHTHALMUS TENUIS Horn, Trans. Am. Ent. Soc., 1871, 327 ; Id., Geol. Surv. Ind., 1872, 177 ; Packard, Mem. Nat. Acad. Sci., IV, 75.

Numerous specimens were received, representing the following localities: Wyandotte Cave, on top of "Monument Mountain," near "Throne" and near "Crayfish Spring; Sibert's Well Cave, Mayfield's Cave, Truett's Cave and Shiloh Cave. Very little variation is exhibited, though occasionally there is a tendency toward a greater acuteness of the hind angles of the thorax, quite possibly due to irregular shrinkage of

the very soft integuments. This is one of the true cave beetles, and is never found elsewhere. *A. eremita* Horn is described from Wyandotte Cave, but no specimens were found among Professor Blatchley's material.

But one specimen was taken in each of the caves except Wyandotte, where it was rather plentiful in the localities above mentioned, about 20 having been taken along the margin of the rivulet flowing from "Crayfish Spring." It was found only in remote parts of the caves in which it occurred, and was always crawling rapidly over mud, sand, or rocks in damp localities. It is a small, light-brown species, with no vestige of eyes, and appeared wholly unaffected by the light of a candle when the latter was held within a few inches of it.

Like other Carabids, these small blind beetles are supposed to be carnivorous. In Wyandotte specimens of mites, spiders, podurids, and harvestmen were taken in the same localities as the beetles, and probably furnish the latter a scanty supply of food. This species was first described from Wyandotte and has since been recorded from Bradford and Donnelson's Caves.—W. S. B.

PTEROSTICHUS SAYI Brulle, Silb. Rev. Entom., III, 277. *Chalcites* Say, Trans. Am. Phil. Soc., II, 56; Ent. Works, Lec. Ed., II, 479. *Micans* Chaud. Bull. Mosc., IV, 767.

Common above ground over most of the United States east of the Rocky Mountains. Taken in Eller's Cave by Mr. Blatchley.

PLATYNUS CINCTICOLLIS Say, Trans., Am. Phil., Soc., N. S., II, 52; Ent. Works, Lec. Ed., II, 476; Le Conte, Proc. Acad. Nat. Sci. Phila., 1854, 43; Bull. Bklyn. Ent. Soc., II, 46 and 55.

Porter Cave, five specimens not different from above-ground examples in my collection. Inhabits Canada and the northeastern United States, extending south through the Middle States. Not a true cave beetle.

The specimens were taken from beneath stones by the side of the cave stream about 250 feet back from the mouth.—W. S. B.

HARPALUS PENNSYLVANICUS De Geer, Mem. Hist. Ins., IV, 108. Olivier, Entomologie, III, 72. Say, Trans. Am. Phil. Soc., II, 28; Ent. Works, Ed. Lec., II, 456.

Clifty Cave, one specimen from the side of a stream 1,700 feet from the mouth, probably of accidental occurrence. Very abundant above ground throughout southern Canada and the greater part of the United States.

STENOLOPHUS OCHROPEZUS Say, Trans. Am. Phil. Soc., II, 54; Ent. Works, Lec. Ed., II, 478. Dejean, Species General, IV, 411. Le Conte, Proc. Acad. Nat. Sci. Phila., 1868, 377.

Porter Cave, one specimen of the ordinary form. This is another beetle of extremely wide distribution, and there is little doubt of its occurrence in the cave being merely fortuitous.

BRADYCELLUS RUPESTRIS Say, Trans. Am. Phil. Soc., II, 91; Ent. Works, Ed. Lec., II, 505. Le Conte, Proc. Acad. Nat. Sci., Phil., 1868, 381.

Porter Cave, one specimen. Very widely distributed and common over a large part of North America.

Family HYDROPHILIDÆ.

PHILHYDRUS sp. indet.

Porter Cave, one immature specimen in otherwise bad condition; taken from beneath a stone in margin of stream 300 feet from mouth.

Family SILPHIDÆ.

A specimen seeming to belong here is among the material from Coon's Cave. It is in too poor condition to render proper study possible. The best course, in the absence of other material, seems to indicate its preservation until more specimens are secured.

It was taken from beneath a stone 400 feet from the entrance.—W. S. B.

Family STAPHYLINIDÆ.

RHEOCHARA LUCIFUGA Casey, Ann. N. Y. Acad. Sci., VII, 1893, 288. *Calodera cavicola* Garman, Psyche, VII, 1894, 81.

Both the above descriptions were based on specimens taken from small caves near Lexington, Ky. The specimens taken by Mr. Blatchley were identified by Capt. Thos. Casey.

Two specimens were secured in Truetts's Cave, Monroe County, about 700 feet from the entrance. They were found beneath some moldy chicken bones left by preceding visitors. Casey, *loc. cit.*, says: "This interesting species is said to inhabit caves, but, as the eyes are well developed, it probably only seeks their seclusion and darkness during the day." Garman, *loc. cit.*, says of it and another species: "Both have pretty well developed eyes, and may, therefore, live at times in ordinary situations, but they are perfectly at home in the deepest parts of caves, and are at times very abundant there. In all my collecting in ordinary situations I have not seen either species out of doors, and am disposed to consider them true cave dwellers."

Mr. Garman is doubtless right, for no beetle is going to crawl into the deepest recesses of caves each day and emerge again at night. So far the species has only been found in caves, and, like *Quedius spelæus* Horn, has probably inhabited them too short a time to entirely lose the eyes.—W. S. B.

QUEDIUS FULGIDUS Fabr., Mantissa Insectorum, I, 220. = *iracundus* Say, Trans. Am. Phil. Soc., IV, 449; Ent. Works, Ed. Lec. II, 564. Horn, Trans. Am. Ent. Soc., VII, 158. Hamilton, Trans. Am. Ent. Soc., XXI, 366.

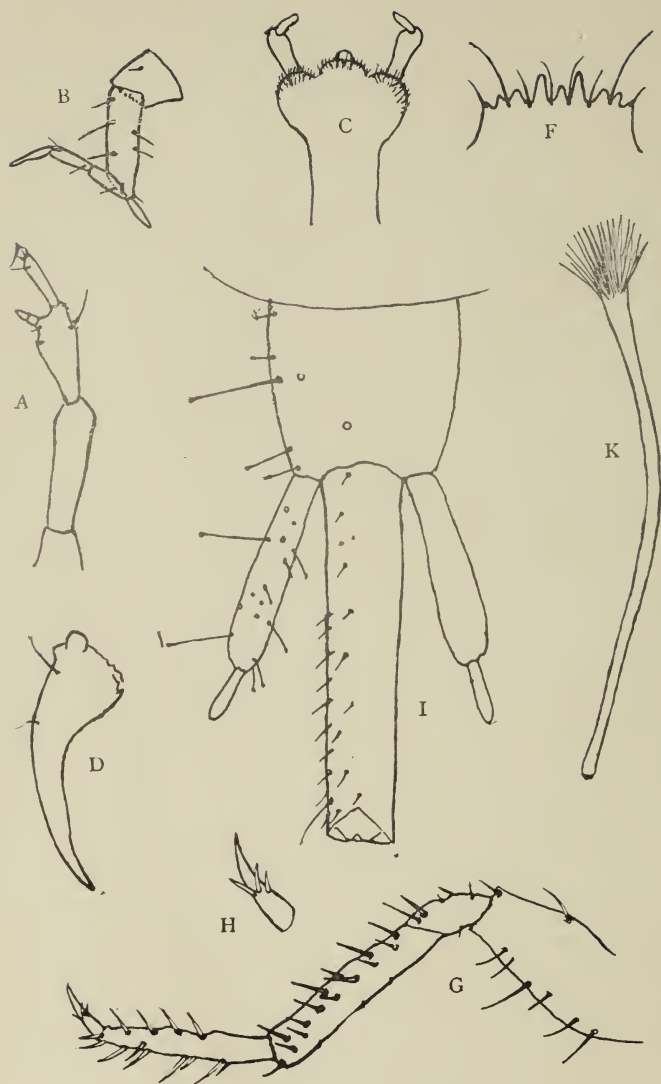
Donnehue's and Marengo Caves. These are true *fulgidus*, with reddish elytra, the head, thorax and abdomen black. Widely distributed (above ground), being found, according to Dr. Hamilton's recent Catalogue, over all of North America, as well as in the other continents, except South America. Recorded from Weyer's and Dixon's Caves in Virginia and Kentucky by Dr. Packard.

Taken from piles of the excrement of raccoons (?) in Donnehue's Cave, and from beneath half decayed boards in Marengo; in both instances in total darkness, 300 or more feet from the entrance.—W. S. B.

QUEDIUS SPELÆUS Horn, Trans. Am. Ent. Soc., 1871, 332; Id., *l. c.* VII, 158; Id., Ind. Geol. Surv., 1872, 179.

Several specimens, Wyandotte Cave, near "Fat Man's Misery," Mayfield's, Clifty, Donnehue's, Truett's and Coon's Caves. In some of the specimens the elytra and tip of the abdomen tend to become bluish. Varies in size from 6.25 to 12 mm.; Dr. Horn's specimens were 14 to 15 mm. long. A single specimen is known from Colorado.

A number of larvæ are among Professor Blatchley's collections from Donnehue's Cave, Clifty Cave (July 17), and Eller's Cave (450 feet). As no description has hitherto been printed, the following is appended: Larva of ordinary staphylinidous form, very elongate, subcylindrical, slightly tapering. Color, in alcohol, nearly white, occasionally yellowish; the head, thoracic scutes, legs and terminal appendages testaceous or castaneous. Length of largest specimen, 15 mm. Head as long or a trifle longer than the prothorax, sides parallel to near the hind angles, which are rounded; base truncate. Mandibles slender, curved regularly on the outer side, irregularly on the inner, not toothed. The maxillæ are composed of a rather heavy basal joint, followed by a second articulation of about twice the length, which bears a rather slender appendix at its inner distal end; exterior to this appendix is borne the remainder of the maxilla, composed of three joints of very nearly equal length, no one of which is quite half as long as the second. Bristles are few, and as nearly as can be made out are located as follows: One near the base of the first joint, three on the inner and three on the outer edge of the second joint, one near the base of the third; the fourth joint bears one near the base and one near the tip. The fifth joint is not armed and is rapidly narrowed near the middle, continuing slender to tip. Labium very small, free portion elongate, nearly parallel-sided to near the tip, becoming rapidly broader and tri-lobed at apex, which is finely and densely bristled. Palpi borne on the outer lobes, two jointed, basal joint much the larger. The middle lobe bears a small blunt process articulated to its center. Above the mouth, the margin of the head (clypeus?) is armed with nine teeth, of which one on each side of the middle tooth is larger and longer than the remainder. The outer three teeth on each side are the shortest.



QUEDIUS SPELEUS. (LARVA.)

There are eight long bristles near the edge of this organ, of which the one next the outer is much longer than the rest. Antennæ with short basal joint, second much longer, third shorter than the second, gibbous beyond the middle, the gibbosity with an external and an internal long bristle. On the inner edge of this gibbosity, near the tip of the joint, arises also a very small two-jointed appendix, near the base of which is a small bristle. The fourth joint proper is shorter than the third, slender, tipped with three minute bristles and with a larger one inside, near the tip. Eyes wanting. Prothorax at base about as wide as the head, sides arcuately narrowing to apex; pronotal scute margined all around, meso and metathorax slightly broader, but much shorter, the dorsal scutes margined. Legs moderate in length, the coxæ rather elongate and with about six spines on their outer face, two or three on the inner. Trochanter and femur spinose, the latter joint about as long as the coxa. Tibia shorter, very spiny, not broader at tip; claw single, slender, slightly curved, tri-spinose before the middle. Abdomen with the first four segments shorter than the remainder, the first narrower than the three following. The fifth, sixth, seventh and eighth are about equal in length among themselves, but gradually narrower. Ninth much more slender, bearing at apex the anal proleg, which is parallel-sided, finely spinose, less so near the base. The anal appendages are two in number, two-jointed, the second joint small and short. They arise one on either side of the proleg, and are armed with a number of curious brush-tipped spines, of which two on the outer edge are longer than the others. These brush tipped spines are also to be found on the sides of the ninth segment.

The accompanying plate will illustrate the points of structure brought out above. The antenna is represented at a; b represents a maxilla; c, the labium; d, the mandible; f, the front margin of the head; g, a leg; h, claw of same; i, the ninth abdominal segment with its appendages, and k, a brush-tipped spine.

Both the mature insects and the larvæ of *Quedius speleus* were in all instances taken in decaying organic matter, or beneath stones in the vicinity thereof. Most of the larvæ were in piles of the excrement of raccoons. Although Cope and Packard both refer to this as a "twilight species," all specimens taken by me were in total darkness, those in Wyandotte Cave being 1,000 feet from the mouth.—W. S. B.

CRYPTOBIUM BICOLOR Grav., Coleoptera Microptera, 179. Say, Trans. Am. Phil. Soc., IV, 454; Ent. Works, Ed. Lec., II, 570. Horn, Trans. Am. Ent. Soc., XII, 62.

One specimen, Porter's Cave; undoubtedly accidental in occurrence, as it is like above ground specimens.

HEMIPTERA.

Family CORISIDÆ.

CORISA sp.?

No members of the order Hemiptera have as yet been recorded as inhabiting caves. In dredging the stream flowing through Shiloh Cave, Lawrence County, two specimens of aquatic bugs belonging to the genus *Corisa* were taken about 300 feet from the entrance, and in the same pool as the blind crayfish, *Cambarus pellucidus* (Tellkamp).

The bugs were sent to Mr. E. P. Van Duzee, who wrote me concerning them as follows: "Your species belong to the group represented by *C. erichsonii*, *limitata* and *stigmatica*, but it differs a little from each and may be distinct from any. It seems to be nearest *erichsonii* Fieb, though I would dislike to label it as such without a pretty emphatic question mark."

The compound eyes of the insect appear well developed, and it may be only an accidental visitor in the cave.

ORTHOPTERA.

Family LOCUSTIDÆ.

CEUTHOPHILUS STYGIUS (Scudd.).

Raphidophora stygius Scudd., Proc. Bost. Soc. Nat. Hist. VIII, 1861, 9.

Pack., Amer. Nat., V., 1871, 745.

Ceuthophilus stygius Scudd. Bost. Jour. Nat. Hist., VII, 1862, 438.

Pack. Guide Stud. Ins. 1869, 565.

Riley Stand. Nat. Hist., II, 1884, 184.

Packard, Mem. Nat. Acad. Sci., IV, 1888, 70, 83.

Brunner, Monog. Stenop., 1888, 309.

Blatch., Proc. Ind. Acad. Sci., 1892, 148.

Scudd., Proc. Amer. Acad. Sci., XXX, 1894, 33.

Ceuthophilus sloanii Pack., Ann. Peab. Acad. Sci., V, 1873, 93.

Id., Mem. Nat. Acad. Sci., IV, 1888, 71, 83.

This "cave cricket" occurs abundantly in crevices in the walls and roof near the mouths of Wyandotte, Little Wyandotte, Sibert's Well Cave and Salt Petre Cave, Crawford County, and a few immature specimens, pronounced by Mr. S. H. Scudder to be the same species, were taken in Porter's, Truett's and Strong's Caves, 80 miles farther north. In the Crawford County caves no specimens were found farther back than 250 feet from the mouth; in the other caves they were found back beyond the reach of any rays of light.

The adults of this species seem to be more or less gregarious. In one instance, in Sibert's Well Cave, more than 20 were found in a small cranny in the wall. They were grouped in a circle, in a space about six inches square, with their antennæ pointing toward the center of the circle, and appeared to be holding a conference or cricket convention.

In regard to the life history of this insect, but little is known. I found a number of specimens of the half-grown young in Sibert's Cave in May, 1895. The adults were common in July, 1896; and in November, the young about one-third the size of mature specimens were frequent in Salt Petre Cave, but could not be found elsewhere.

The species may be represented in winter by the young as well as by eggs, as is the case among some other members of the genus.*

According to Mr. Rothrock, *stygius* is sometimes found as far back in Wyandotte Cave as the top of "Monument Mountain." I searched for it there on the three dates above mentioned and could find no specimens.

In Salt Petre Cave, where in July they were very plentiful, all were found within 100 feet of the entrance. They were never seen on the floor, unless they leaped there when disturbed, but were found resting on the sides of small projections and in small cavities of the walls or roof, with their antennæ spread out before them. If a lighted candle were held close to them they paid no attention to it, but were very sensitive to its heat and to touch. When disturbed they leap with agility, sometimes to a distance of six feet, but with a little care can usually be readily picked up with the fingers before they become frightened.

This is the largest of the seven species of Stone or Camel crickets belonging to the genus *Ceuthophilus* which are known to occur in Indiana.

A number of the larger specimens taken in Salt Petre and Sibert's caves measured as follows:

	Males.	Females.
Length of body.....	30.0 mm.	26.0 mm.
Length of pronotum.....	7.5 mm.	6.5 mm.
Length of front femora	15.0 mm.	12.5 mm.
Length of hind femora.....	26.0 mm.	24.0 mm.
Length of hind tibia.....	27.5 mm.	25.0 mm.
Length of antennæ.....	103.0 mm.	96.0 mm.
Length of ovipositor.....		16.0 mm.

But little variation was noted in the color of mature specimens, though they varied much in size.

The immature ones from caves in Monroe and Owen Counties were darker than typical *stygius*, and were found on the floor of the caves—in one or two instances beneath loose rocks. From their habits, I am somewhat inclined to doubt their being *stygius*, since it is difficult to always name correctly an immature specimen. The *C. sloanii* of Packard,

*See Proc. Ind. Acad. Sci., 1892, 141.

from Bradford and Little Wyandotte Caves, has been pronounced by Scudder, who has recently monographed the genus, to be the young of *stygius*.

THYSANURA.

Family PODURIDÆ.

DEGEERIA CAVERNARUM Packard.

Packard, Memoir Nat. Acad. Sci., IV,
1888, 66, Pl. XVI.

This small Thysanuran was described from specimens taken in Little Wyandotte Cave, and has been recorded also from Bradford Cave, and from several Kentucky caverns. It was found by our party to be the most common form of life in each of the following caves: Mayfield's, Truett's, Eller's, Shiloh, Clifty, Marengo, Little Wyandotte and Wyandotte.

Like most other cave inhabiting insects, it occurs only in comparatively moist places, often swarming by thousands beneath or on the surface of damp rocks, especially where organic matter, such as the remains of lunches, drippings from candles, decaying wood, etc., was scattered.

It has the power of leaping several inches by means of a long, spring-like appendage bent under the hind body, which on being released throws the insect high in the air.

Since the species is so common in Indiana caves, its description, as given by Packard, is copied herewith, as follows:

"Whitish, with a slight yellowish tint; usually blind; no traces of eyes. Body of the usual form of the genus; antennæ of great length, two-thirds as long as the body, and more than twice as long as the head; basal joint longer than usual; fourth joint very long and slender. Legs: Last joint with fine, slender scales; the claws much as in *D. grisea* Pack., but the spines on the larger claw are less distinct and the tenent hair shorter; the spring long and slender; the second joint serrulate along the under side nearly to the base: third (terminal) joint long and slender, ending in three teeth; the terminal tooth claw-like, as usual. The colophore is large and well developed.

"Length of body, without the spring 3 mm."

This Podurid doubtless forms much of the food of the small spiders, harvestmen and beetles which inhabit the caves.

Two additional members of the order Thysanura, viz.: *Campodea cookei* Pack., and *Machilis* sp., are recorded by Packard* as occurring in Wyandotte, but no specimens of either were taken by us.

*Mem. Nat. Acad. Sci., IV, 1888, 15, 67.

MYRIAPODA.

POLYZONIUM ROSALBUM (Cope).

A single specimen from Evaston's Cave, 100 feet from the mouth. Probably an accidental visitor, the species being a rather common above-ground form, living beneath half-buried logs.

SPIROSTREPHON LACTARIUM (Say).

This is a common above-ground species throughout the eastern United States, and, according to Packard, was probably the parent of *Pseudotremia cavernarum* Cope, the common species found in Wyandotte Cave. A single specimen was taken from the roof of Mayfield's Cave, 700 feet from the entrance.

PSEUDOTREMIA CAVERNARUM Cope.

Pseudotremia cavernarum Cope. Jour. Am. Phil. Soc., XI, 1869, 179. Id., Trans., Am. Ent. Soc., III, 1870, 67.

Bollman, Proc. U. S. Nat. Mus., XI, 1888, 405. (Wyandotte, Little Wyandotte, Bradford's and Marengo Caves.)

Packard. Mem. Nat. Acad. Sci., IV, 1888, 61, Pl. VI.

Cook and Collins, Ann. N. Y. Acad. Sci., IX, 1896, 36. (Wyandotte and Marengo Caves.)

Spirostrephon cavernarum Cope. Am. Nat., VI, 1872, 409

Id., Geol. Surv. Ind., 1872, 161, 167.

Id., Geol. Surv. Ind., 1878, 493, 499.

This species was found to be very common in Marengo, Wyandotte and Little Wyandotte Caves. It frequents damp localities, especially masses of stalagmite over which water is trickling, and is usually crawling very rapidly, for one of its kind. It has not been taken in the State north of Crawford County, and outside of the State only at a few points in Virginia and Tennessee.

The fact that Mammoth Cave and vicinity has a peculiar myriapod, *Scotherpes copei* (Pack.); the northern caves of Indiana, another—*Conotyla bollmani* (McNeill), and the Virginia caves a third, *Zygonopus whitei* Ryder, while in the Wyandotte region we find abundantly the *P. cavernarum* is strong evidence of the origin of each of these species from a different type which inhabited the region in which the corresponding cave form is now found. A closely allied species, *P. carterensis* Packard, has been recorded* from Sibert's Well Cave. It was previously known from Carter Caves, Kentucky. No specimens were secured by us.

* Bollman, Proc. U. S. Nat. Mus., XI, 1888, 405.

CONOTYLA BOLLMANI (McNeill).

Trichopetalum bollmani McNeill, Proc. U. S. Nat. Mus., X, 1887, 330. (Mayfield's Cave.)

Scotherpes bollmani Bollman, Proc. U. S. Nat. Mus., XI, 1888, 405. (Mayfield's, Neeld's, Truett's and Coons' Caves, Monroe Co.; Phitts' and Donnehue's Caves, Lawrence Co.)

Conotyia bollmani Cook and Collins, Ann. N. Y., Acad. Sci., IX, 1896, 76. (Localities as above.)

This appears to be an abundant myriapod in the caves of Lawrence and Monroe Counties. It was taken by us in all the caves cited above which were visited, and also in Porter's Cave, Owen County, but was not noted in the caves of Crawford County. It was usually found beneath stones in the vicinity of decaying organic matter.

SCYTONOTUS GRANULATUS (Say).

Another epigæal species, a single specimen of which was taken from Little Wyandotte, 200 feet from the entrance. From this cave a few specimens of *Cambala annulata* (Say), another above-ground species, were taken by Packard and recorded in his "Cave Fauna," p. 65.

LITHOBIUS SP.?

A single specimen from Shiloh Cave, 200 feet back. Of this Mr. Cook wrote: "This may be a true cave species, since the eyes seem not normally pigmented, but this is perhaps due to the contraction of the tissues in alcohol. The anal legs are wanting, so that a satisfactory specific determination can not be made."

ARACHNIDA.

The members of this group were named for me by Mr. Nathan Banks, Sea Cliff, N. Y., who also prepared the descriptions of the two new species which follow:

ARANEIDA (The Spiders).

Family AGALENIDÆ.

TEGENARIA CAVICOLA n. sp.

Length female (immature) 6 mm. Cephalothorax pale, eyes on black spots, more or less connected; a black line from the P. S. E. backward uniting at dorsal groove, a fine line from the P. M. E. forked and one branch joining the line from P. S. E., three dark spots each side, a black seam, and a line each side behind from the dorsal groove; mandibles pale; legs pale, with two dark rings on the femora and tibiæ, incomplete on

the former, also blackish at tips; sternum blackish, paler in center; abdomen pale above, with many black marks so thick behind as to leave only a few white chevrons, in front a median spear mark, and spots each side; venter blackish with a white stripe each side. Cephalothorax quite broad, much narrowed in front, P. M. E. about their diameter apart, fully as far from the equal P. S. E.; A. M. E. smaller, less than diameter apart and closer to the larger A. S. E. Mandibles long, vertical; legs long and slender; sternum broad, sides rounded, pointed between hind coxæ; abdomen nearly twice as long as broad, convex above, rather blunt at tip.

Two young females from Salt Petre Cave, Crawford County, Indiana. Quite different from any eastern *Tegenaria*, more like *T. californica*.

This species was taken about 75 feet back from the entrance of the cave. It spins a handsome web, basket-like in form, attached to the roof. When approached with lighted candle, the spiders came down from a crevice in the roof on the side of the web nearest us. Several were seen but only two taken.—W. S. B.

Family EPEIRIDÆ.

META MENARDI Latr.

This was found to be the most common spider in Indiana caves. It was taken in Mayfield's, Strong's, Donnehue's, Donnelson's, Clifty, Wyandotte and Salt Petre Caves, usually within 250 feet from the mouth. The specimens varied much in age and size. They were usually found hanging from the roof or projection of wall by a single thread, with a loosely constructed web near by. According to Banks, "The Meta is not uncommon in dark and shady places in the eastern States, and probably elsewhere, but much more abundant in small caves. It is an European species."

Family LYCOSIDÆ.

DOLOMEDES URINATOR Hentz.

An above ground form which was taken about 50 feet back from the mouth of Donnelson's Cave.

Family THERIDIDÆ.

THERIDIUM PORTERI n. sp.

Length of female, 3.8 mm., femur I, 3 mm. Cephalothorax pale yellowish, infuscated on the pars cephalica, and a blackish marginal seam. Mandibles yellow-brown; sternum a little darker; legs pale, yellow-brown marks as follows: a stripe in front of femur I, a spot on the middle of femora II and III, a ring at end of all femora, whole of patellæ, and bands before middle and at tip of all tibiæ and metatarsi, very broad on the latter joints. Abdomen light or dark gray, often with two large

dark patches above near the base, and a larger, irregular transverse mark behind, besides some scattered dots. Cephalothorax rather short and broad; mandibles normal; sternum nearly triangular, longer than broad; abdomen globose, high and convex. The epigynum shows two small red circles connected behind by an emarginate ridge. Eyes well developed, all about equal in size, P. M. E. about their diameter apart, as far from the P. S. E.; A. M. E. hardly their diameter apart, rather closer to the A. S. E.; S. E. touching. What I take to be the male is about the same size, with reddish, longer legs, and a less globose abdomen, wholly pale gray. The stout, black style is coiled once around the top of the bulb, and its tip rests in a long, stout, black sheath, very prominent. Five females and one male, Porter Cave, Indiana.

A common species in a large room with low ceiling near the source of the cave. They were found suspended by a single thread, with scattered threads of webs near by. Near each specimen was always one, and sometimes two, small cocoons of the usual form for the genus *Theridium*, and white in color. This species was also noted in the first room of Truett's cave.—W. S. B.

TMETICUS TRIDENTATUS Em.

A single pair were secured from the floor of Porter Cave, Owen County, 250 feet from the mouth.

NESTICUS CARTERI Em. Am. Nat., IX, 1875, 279; Id., Pack., Mem. Nat. Acad. Sci. IV, 1888, 57.

This species was taken in Porter's, Coons' and Marengo Caves. It had been before recorded only from caves in Carter County, Kentucky. It is a small, light yellow species, and was found crawling over the surface of damp rocks, 200 to 500 feet from the entrance.

This and the next species are wandering spiders, and spin no web. They evidently feed upon the Thysanuran, *Degeeria cavernarum* Pack., which was abundant wherever they were found.

PHANETTA SUBTERRANEA (Em).

Linyphia subterranea Em, Am. Nat., IX, 1875, 279.

Id., in Pack., Mem., Nat. Acad. Sci., IV, 1888, 57.

This small, pale, pinkish-brown species was described from specimens taken in Wyandotte. We found it scarce, but three or four specimens being seen. It has essentially the same habits as *Nesticus carteri* Em.

PHALANGIDA (The Harvestmen).

Family PHALANGODIDÆ.

SCOTOLEMON FLAVESCENS (Cope.)

Erebomaster flavescens Cope., Am. Nat., VI, 1872, 420, figs. 114-115.

Id., Geol. Surv. Ind., 1872, 168, 177.

Id., Geol. Surv. Ind., 1878, 501.

Phalangodes flavescens Pack., Mem. Nat. Acad. Sci., IV, 1888, 49, pls. XII and XV.

This is the most common Arachnid in Wyandotte Cave, its only previously known locality. It is a pale yellow species, with distinct eyes, although it occurs in remote portions of the cave, being most common on the damp stalagmite at the base of the "Pillar of the Constitution" and on top of "Monument Mountain." What they feed upon is as yet unknown, though probably, like the two spiders above mentioned, the Podurans form a portion of their diet. A few specimens were secured in Clifty Cave, Washington County.

PSEUDOSCORPIONIDA (The Chelifers).

Family OBISIDÆ

CHTONIUS PACKARDII Hagen.

Chtonius packardii Hag., Zoöl. Anzeig., II, 1879, 399.

Id., Amer. Entom., III, 1880, 83.

Pack., Mem., Nat. Acad. Sci., IV, 1888, 43.

The type specimens of this small, semi-blind chelifer came from Wyandotte. None were secured on our visit in July, but in November three specimens were obtained from the surface of damp rocks one-half mile or more from the entrance. It moves slowly along with its chelæ held in the air in front, and, being less than one-tenth of an inch in length, is very likely to be overlooked unless especial search is made for it. It has been taken in Mammoth and other Kentucky caves, and varies much in regard to the development of the eyes, some having two eyes, with the cornea as usual; some having no cornea, but retaining the silvery dot indicating the retina, and others being totally blind.*

ACARINA. (The Mites.)

But little has hitherto been published concerning cave mites, and the descriptions of the different species are brief and confusing. Examples of two species were obtained in Wyandotte Cave as follows:

DIPLLOTASPIS sp. ?

This was found to be a common parasite on the wings of both living and dead bats. It is a very small, white form, and probably occurs on bats wherever found. It may prove to be the young of the following:

DIPLLOTASPIS sp. ?

A single specimen of a larger, dark-colored form was found on a damp rock near the remains of waste food, close to the "Augur Hole."

* Pack., Mem. Nat. Acad. Sci., 1888, 47.

CRUSTACEA.

ON A COLLECTION OF CRUSTACEANS FROM INDIANA CAVES.

BY W. P. HAY.

Family GAMMARIDÆ.

Genus CRANGONYX Bate.

CRANGONYX GRACILIS Smith.

Crangonyx gracilis Smith, Am. Jour. Sci. Ser., 3, II, 1871, 453.

Id., Rep. U. S. F. C., 1872-73, 654.

Forbes, Bull. Ill. St. Lab. Nat. Hist., No. 1, 1876, 6.

Hay, O. P., Am. Nat., XVI, 1882, 241.

A number of specimens representing this species were taken from the following caves: Eller's, Mayfield's and Donnohue's. The animal is not one given to life in such situations, and I am of the opinion they are to be regarded as accidental visitors only, having been washed by heavy rains into the cave streams, from which they have been unable to make their escape.

Packard in Mem. Nat. Acad. Sci., IV, 1888, p. 36, says that *C. gracilis* "occurs as far south as Grand Rapids, Mich., whereas Forbes, *loc. cit.*, had already stated that it was common in southern Illinois. It is much the larger of the three species taken in Indiana caves. It was first known to occur in Mayfield's Cave in 1886, when it was taken by the late C. H. Bollman. From the nature of the stream in this cave I do not think it is possible for it to escape, and the facilities are, therefore, excellent for a future study of the length of time necessary to bring about organic changes due to cave environment.—W. S. B.

CRANGONYX VITREUS (Cope).

Stygobromus vitreus Cope., Am. Nat. VI, 1872, 422.Id., Geol. Surv. Ind., 1872, 165, 181;
1878, 408.*Crangonyx vitreus* Smith, Rep. U. S. F. C., 1872-73, 656.

Id., Am. Jour. Sci. Ser. 3, IX, 1875, 476-7.

Packard, Mem. Nat. Acad. Sci., IV, 1888, 34.

This species is represented in the collection by nearly a dozen small specimens which were taken from a wooden trough in Salt Petre Cave, Crawford County. The crustaceans originally described by Cope, and later by Smith, were from Mammoth Cave of Kentucky. The present record, therefore, extends their range very materially.

CRANGONYX PACKARDII Smith.

Crangonyx packardii Smith, Am. Jour. Sci. Ser. 3, IX, 1875, 476-7.

Packard Mem. Nat. Acad. Sci. IV, 1888, 35.

Crangonyx vitreus Packard, 5th Rep. Peabody Acad. Sci., 1873, 95.

Seven specimens of this subterranean crustacean were taken at Crawfish Spring in Wyandotte Cave. They differ from *C. vitreus* in having small eyes, and are evidently more closely related to *C. gracilis*, from which both have probably descended.

The type specimens of this species were obtained from wells in Orange County by Dr. M. N. Elrod. Others were afterwards secured from a well in New Albany by Dr. John Sloan. These are its only previous records. It swims very rapidly, jerking itself hither and thither through the water in a zigzag course, and is extremely difficult to capture. In July a number of specimens of this or the preceding species were noted in the "Spring of Deception," near the "Throne," in Wyandotte, but all escaped capture. In November the water in this spring had disappeared, and the bottom was covered with very soft, sticky mud. In this a number of small holes resembling the burrows or pits of angle worms were noted. Each had numerous particles of dry, sand-like grains of mud about the mouth. The pits were probed and cut out with a knife, but no living form could be found. In my opinion they were formed by the small *Crangonyx*, of which no trace remained.—W. S. B.

Family ASELLIDÆ.

Genus CÆCIDOTÆA Packard.

CÆCIDOTÆA STYGIA Packard.

Cæcidotea stygia Packard, Am. Nat. V, 1871, 751.

Id., Rept. Peabody Acad. Sci., V, 1873, 95.

Smith, Rep. U. S. F. C., 1872-73, 661.

Hubbard, Am. Etom., N. Ser. I, 1880, 36, 98.

Packard, Mem. Nat. Acad. Sci., IV, 1888, 29.

Cæcidotea microcephala Cope, Am. Nat. VI, 1872, 411.

Id., 3d and 4th Rep. Geol. Surv. Ind., 1872, 163, 174.

Smith, Am. Nat. VII, 1872, 244.

Asellus stygius Forbes, Bull. Ill. State Lab. Nat. Hist., I, 1876, 11.

Numerous specimens of this crustacean were taken from the following caves: Strong's, Eller's, Mayfield's, Marengo, Wyandotte, Salt Petre and Evaston's.

Although *Cæcidotea stygia* is apparently strictly subterranean in its habitat, it may occur in many places remote from the cave regions. It has been reported from central Illinois, where it frequents tile drains and wells. I have found it in similar situations in central Indiana and have frequently taken it from wells in the vicinity of Indianapolis.

Described originally from an injured specimen, the affinities of this crustacean were for a long time in dispute, and the literature is, for so small an animal, somewhat voluminous. The first complete description was given by Forbes (see synonymy), who regarded it as being generically identified with the water sow-bugs, which are so common in our ponds and streams. The genus *Cæcidotæa* is now regarded as valid and definable by other characteristics more important than the lack of organs of vision.

This was the most common crustacean noted in Indiana caves. It was usually found singly, swimming or crawling slowly through the water of small cave streams, and was easily picked up with a pair of forceps. In Marengo Cave, however, it was gregarious, hundreds being found on the under side of some rotten boards floating in a pool, 2,000 feet from the entrance. The specimens taken varied much in size, and those from Marengo were much darker in color than the others.—W. S. B.

Family ONISCIDÆ.

Genus PORCELLIO Latreille.

PORCELLIO (sp. indet.).

A single specimen, which I refer to this genus, was taken near the mouth of Wyandotte Cave. On account of the lack of the necessary literature I am unable to carry the identification further.

Family POTOMOBIDÆ.

Genus CAMBARUS Erichson.

CAMBARUS PELLUCIDUS (Tellkampf).

Astacus pellucidus Tellkampf, Arch. Anat. Physiol. u. Wissensch. Med., 1844, 383.

Astacus (Cambarus) pellucidus Erichson, Arch. Naturgesch., XII, 1846, 95.

Cambarus pellucidus Hagen, Ill. Cat. Mus. Comp. Zoo., 1870, No. III, 55.

Putnam, Proc. Bost. Soc. Nat. Hist., XVII and XVIII, 1875.

Faxon, Mem. Mus. Comp. Zoo., X, 1885, No. 4, 40.

Packard, Mem. Nat. Acad. Sci., IV, 1888, 38.

Hay, W. P., Proc. U. S. Nat. Mus., XVI, 1893, 283.
Id., 20th. Rept. Geol. Ind., 1895, 482.

Orconectes pellucidus Cope, Amer. Nat., VI, 1872, 410.

Id., 3d and 4th Rept. Geol. Ind., 1872, 173.

Orconectes inermis Cope, Amer. Nat., VI, 1872, 410.

Id., 3d and 4th Rept. Geol. Ind., 1872, 173.

Twelve specimens of this curious and well-known blind crayfish were collected in the following caves: Wyandotte and the Well caves in Crawford County; Shiloh Cave in Lawrence County; cave east of Mitchell, Lawrence County; Clifty Cave, Washington County. The following list of localities, taken from the Twentieth Annual Report of the Indiana State Geologist, will give an idea of the range of this species: Shiloh, Down's, Donnehue's, Connelly's and Donnelson's caves in Lawrence County; cave at Clifty in Washington County; cave near Paoli and in Lost River, Orange County; Wyandotte, Wildcat and Marengo(?) caves in Crawford County.

The species was first described from specimens from Mammoth Cave in Kentucky, and it has since been taken in other cave streams of that State.

In Indiana the blind crayfish probably occurs throughout the whole cave region and is to be looked for in every cave in which there is a running stream. Careful examination of cave bed streams ought, also, to show its occasional occurrence outside of its subterranean homes. During the heavy rainfalls the water rushes with great violence through the caves and doubtless frequently carries the animals out to the rivers. Here its light color, soft shell and defenseless condition would prove such a heavy handicap that in the struggle for existence its life would be of very short duration.

The blind crayfish inhabits shallow pools with muddy bottom rather than rapid flowing water. It moves slowly with its antennæ spread out before it, and gently waving to and fro, feeling, as it were, every inch of its way. It is wholly non-sensitive to light, and seemingly so to sound, but when disturbed by any movement in the water it is extremely active, much more so than ordinary terrestrial forms, leaping upward and backward with quick, powerful downward blows of its abdomen.—W. S. B.

CAMBARUS PELLUCIDUS TESTII Hay.

Cambarus pellucidus testii Hay, W. P., Proc. U. S. Nat. Mus. XVI, 1893, 283.

Id., 20th Ann. Rept. Ind. State Geol., 1895, 484.

One specimen was examined which was taken from Mayfield's Cave in Monroe County.

So far as our present knowledge goes this peculiar sub-species occurs only in the above mentioned cave and a neighboring one—Truett's.

CAMBARUS BARTONII (Fabricius).

(?) *Astacus bartonii* Fabricius, Suppl. Entomolog. Systemat, 1798, 404.

Cambarus bartonii Hagen, Ill. Cat. Mus. Comp. Zoo. No. III, 1870, 75.

Faxon, Mem. Mus. Comp. Zoo. X, No. 4, 1885, 59.

Hay, W. P., 20th Ann. Rep. Ind. State Geol., 1895, 487.

This crayfish, although usually regarded as an inhabitant of surface waters, seems to take very kindly to a subterranean abode when the opportunity is offered. Whether it passes its whole life here or makes visits to the outside is a question, but in several cases I have taken the animal in places from which I can scarcely believe it could have made its escape. In the present collection the specimens came from Strong's Cave in Monroe County; Clifty Cave, Washington County; Donnehue's Cave, Lawrence County, and Spring Cave, Owen County. In the Clifty Cave *C. bartonii* was found within 50 feet of individuals of the eyeless *C. pellucidus*.

BIBLIOGRAPHY OF INDIANA CAVES AND THEIR FAUNA.

BY W. S. BLATCHLEY.

The following is a list of such papers and works as have come to my notice, referring in whole or in part to Indiana caves and their fauna. Brief attention is called to the particular feature of each pertaining to Indiana caves.

BROWN, DR. R. T.—In Trans. Ind. State Agr. Soc., 1853, 309. Describes very briefly Wyandotte; mentions a "lizard about three inches long and without eyes as the only living inhabitant of the cave."

BROWN, DR. R. T.—13th Rep. Ind. Geol. Surv., 1883, 78. Gives a brief description of Porter's Cave.

COLLETT, JOHN.—Rep. Ind. Geol. Surv., 1872, 149. Gives a brief description of Wyandotte and Little Wyandotte caves.

COLLETT, JOHN.—Geol. Surv. Ind., 1873. Describes briefly Shiloh Cave, p. 289; Dry Cave, p. 290; Connelly's Cave, p. 298; Hamer's Cave, p. 303; Donnelson's Cave, p. 304. Gives brief list of animals found in the last three caves mentioned.

COLLETT, JOHN.—Geol. Surv. Ind., 1875, 321. Mentions briefly Miller's (Porter's) Cave, Owen County.

COLLETT, JOHN.—"Wyandotte Cave."—Rept. Ind. Geol. Surv., 1878, 456. Gives a rather full popular description, accompanied by map, of the cave. Treats also Salt Peter Cave and Little Wyandotte on p. 507; King's Cave, Harrison County, on p. 370, and Rhode's Cave, Harrison County, on p. 360.

COPE, E. D.—Ind. Daily Journal, Sept. 5, 1871.

COPE, E. D.—“On the Wyandotte Cave and Its Fauna.”—Am. Nat., VI, 1872, 406. Makes brief mention of the more interesting features of the cave and gives an account of its fauna as then known, together with descriptions of a number of forms supposed to be new.

COPE, E. D.—Reprint of the above in Repts. Ind. Geol. Surv., 1872, 157, and 1878, 487.

EMERTON, J. H.—“Notes on Spiders from Caves in Kentucky, Virginia and Indiana.” Am. Nat. IX., 1875, 278. Describes and figures *Linyphia subterranea*, a spider from Wyandotte.

FLINT, E. H.—“History and Geography of the Mississippi Valley,” 3d Ed., 1833, 389. Contains a brief description of Wyandotte Cave, under the name of “Epsom Salts Cave.”

HAGEN, DR. H.—“The Blind Crayfish”—Am. Nat., VI, 1872, 494. States that Cope’s genus, *Orconectes*, proposed for the blind crayfish is not valid, and that the species *O. inermis* from Wyandotte is but a form of *Cambarus pellucidus* (Tellk.).

HAY, W. P.—“Observations on the Blind Crayfishes of Indiana, with a description of a New Subspecies.”—Proc. U. S. Nat. Mus., XVI, 1893, 283. Plates.

An excellent account of the habits of *Cambarus pellucidus* (Tellk.), with description of the subspecies *testii*. Also remarks on Shiloh and Mayfield’s caves.

HOVEY, REV. H. C.—“Celebrated American Caverns, especially Mammoth, Wyandotte and Luray,” 1882.

Mentions briefly several of the caves in Lawrence County, and gives an extended popular account of Wyandotte, accompanied by maps and illustrations.

MERCER, H. C.—Am. Nat., 1894, 1,065.

MERCER, H. C.—“Jasper and Stalagmite Quarried by Indians in Wyandotte Cave.” Proc. Amer. Phil. Soc., XXXIV, 1895, 396.

In these two papers Mr. Mercer states his doubts of the alleged age, as given by Hovey, of the stalagmite quarry near the base of the “Pillar of the Constitution” in Wyandotte. In the second paper he describes briefly the quarry and mentions other discoveries made by him, which tend to prove the Indians’ former inhabitancy of Wyandotte.

OWEN, RICHARD.—Ind. Geol. Surv., 1859-’60, 149. Gives a four-page description of Wyandotte, accompanied by two illustrations and a good map, the latter in appendix to the volume.

PACKARD, A. S., JR.—“The Invertebrate Cave Fauna of Kentucky and Adjoining States.” Am. Nat., IX, 1875, 274. Mentions the habits of *Linyphia subterranea*, a small spider found in Wyandotte, also comments on the origin of the myriapod therein found.

PACKARD, A. S., JR.—“The Cave Fauna of North America with Remarks on the Anatomy of the Brain and Origin of the Blind Species.” Mem. Nat. Acad. Sci., IV, 1888. Treats in detail the fauna of Wyandotte and Bradford caves; gives brief description of Clifty Caves, Washington County. Gives full descriptions of many cave animals, with notes on origin, changes due to environment, etc. The most valuable work extant on cave fauna.

PACKARD, A. S., JR.—“The Effect of Cave Life on Animals.” Popular Science Monthly, XXXVI, 1890, 339. Discusses the origin and changes due to environment of certain animals found in Bradford and Wyandotte caves.

PUTNAM, F. W.—“The Blind Fishes of Mammoth Cave and Their Allies.” Am. Nat., VI, 1872, 6. Mentions the occurrence of *Amblyopsis spelaeus* in Wyandotte Cave and Lost River, Indiana. Discusses its origin and habits, and the changes which it has undergone by cave environment.

STELLE, JAS. PARISH—“The Wyandotte Cave of Crawford County, Ind.,” 1864. A 12mo. volume of 85 pages, giving a good popular description of the cave. The distances, however, are very much exaggerated.



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